

## Bibliography

Adam, E.J. and 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. Jolla, California 92037.

Adam, S.A., Marr, R.S. and Gerace, L. (1990) Nuclear protein import in permeabilized mammalian cells requires soluble cytoplasmic factors. *J Cell Biol*, **111**, 807-816.

Amos, L.A. and Klug, A. (1974) Arrangement of subunits in flagellar microtubules. *J. Cell Sci.*, **14**, 523-549.

Andersen, S. and Karsenti, E. (1997a) XMAP310: a *Xenopus* rescue-promoting factor localized to the mitotic spindle. *J. Cell Biol.*, **139**, 975-983.

Andersen, S.S., Ashford, A.J., Tournebize, R., Gavet, O., Sobel, A., Hyman, A.A. and Karsenti, E. (1997) Mitotic chromatin regulates phosphorylation of Stathmin/Op18. *Nature*, **389**, 640-643.

Andersen, S.S. and Karsenti, E. (1997b) XMAP310: a *Xenopus* rescue-promoting factor localized to the mitotic spindle. *J Cell Biol*, **139**, 975-983.

Arnal, I., Karsenti, E. and Hyman, A.A. (2000) Structural transitions at microtubule ends correlate with their dynamic properties in *Xenopus* egg extracts. *J Cell Biol*, **149**, 767-774.

Askjaer, P., Galy, V., Hannak, E. and Mattaj, I.W. (2002) Ran GTPase Cycle and Importins alpha and beta Are Essential for Spindle Formation and Nuclear Envelope Assembly in Living *Caenorhabditis elegans* Embryos. *Mol Biol Cell*, **13**, 4355-4370.

## Bibliography

---

Bacallao, R., Antony, C., Dotti, C., Karsenti, E., Stelzer, E.H.K. and Simons, K. (1989) The subcellular organization of MDCK cells during the formation of a polarized epithelium. *J Cell Biol*, **109**, 2817-2832.

Bamba, C., Bobinnec, Y., Fukuda, M. and Nishida, E. (2002) The GTPase Ran regulates chromosome positioning and nuclear envelope assembly in vivo. *Curr Biol*, **12**, 503-507.

Bilbao-Cortes, D., Hetzer, M., Langst, G., Becker, P.B. and Mattaj, I.W. (2002) Ran binds to chromatin by two distinct mechanisms. *Curr Biol*, **12**, 1151-1156.

Binarova, P., Cenklova, V., Hause, B., Kubatova, E., Lysak, M., Dolezel, J., Bogre, L. and Draber, P. (2000) Nuclear gamma-tubulin during acentriolar plant mitosis. *Plant Cell*, **12**, 433-442.

Bischoff, F.R., Klebe, C., Kretschmer, J., Wittinghofer, A. and Ponstingl, H. (1994) RanGAP1 induces GTPase activity of nuclear Ras-related Ran. *Proc Natl Acad Sci U S A*, **91**, 2587-2591.

Bischoff, F.R., Krebber, H., Smirnova, E., Dong, W. and 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. and Ponstingl, H. (1995) Catalysis of guanine nucleotide exchange of Ran by RCC1 and stimulation of hydrolysis of Ran-bound GTP by Ran-GAP1. *Methods Enzymol*, **257**, 135-144.

Boleti, H., Karsenti, E. and Vernos, I. (1996) Xklp2, a novel *Xenopus* centrosomal kinesin-like protein required for centrosome separation during mitosis. *Cell*, **84**, 49-59.

Borisy, G.G. (1978) Polarity of microtubules of the mitotic spindle. *J Mol Biol*, **124**, 565-570. and is an active component of cytostatic factor (CSF), an activity responsible for metaphase II arrest. Here we demonstrate that pp539mos is required throughout oocyte maturation. We found that in progesterone stimulated

## Bibliography

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oocytes, depletion of *mos* RNA immediately before GVBD terminally decreased MPF. Likewise, oocytes depleted of *mos* RNA and induced to mature with crude MPF proceeded through GVBD but lacked the MPF activity required to arrest mature oocytes at metaphase II. Thus, during maturation the *mos* product is required, directly or indirectly, to sustain MPF activity. On the other hand, mouse NIH/563T563 cells transformed by the constitutive expression of pp539mosxc possessed CSF activity but lacked constitutive levels of MPF or its associated histone H561 kinase activity. Moreover, cytosols prepared from transformed NIH/563T563 cells or *Xenopus* eggs had similar levels of CSF activity, but pp539mos levels were greater than 540-fold higher in the transformed cell extract. These analyses show that maintenance of CSF during interphase does not result in the maintenance of MPF.

Buendia, B., Draetta, G. and Karsenti, E. (1992) Regulation of the microtubule nucleating activity of centrosomes in *Xenopus* egg extracts: Role of cyclin A associated protein kinase. *J Cell Biol*, **116**, 1431-1442.

Carazo-Salas, R.E., Gruss, O.J., Mattaj, I.W. and Karsenti, E. (2001) Ran-GTP coordinates regulation of microtubule nucleation and dynamics during mitotic-spindle assembly. *Nat Cell Biol*, **3**, 228-234.

Carazo-Salas, R.E., Guarguaglini, G., Gruss, O.J., Segref, A., Karsenti, E. and Mattaj, I.W. (1999) Generation of GTP-bound Ran by RCC1 is required for chromatin-induced mitotic spindle formation. *Nature*, **400**, 178-181.

Clarke, P.R., Klebe, C., Wittinghofer, A. and Karsenti, E. (1995) Regulation of Cdc2/cyclin B activation by Ran, a Ras-related GTPase. *J Cell Sci*, **108**, 1217-1225.

Compton, D.A. (2000) Spindle assembly in animal cells. *Annu Rev Biochem*, **69**, 95-114.

## Bibliography

---

Conti, E. and Kuriyan, J. (2000) Crystallographic analysis of the specific yet versatile recognition of distinct nuclear localization signals by karyopherin alpha. *Structure Fold Des*, **8**, 329-338.

Conti, E., Uy, M., Leighton, L., Blobel, G. and Kuriyan, J. (1998) Crystallographic analysis of the recognition of a nuclear localization signal by the nuclear import factor karyopherin alpha. *Cell*, **94**, 193-204.

Daar, I., Paules, R.S. and Vande Woude, G.F. (1991) A characterization of cytostatic factor activity from *Xenopus* eggs and c-mos-transformed cells. *J Cell Biol*, **114**, 329-335.

Dingwall, C., Sharnick, S.V. and Laskey, R.A. (1982) A polypeptide domain that specifies migration of nucleoplasmin into the nucleus. *Cell*, **30**, 449-458.

Dionne, M.A., Howard, L. and Compton, D.A. (1999) NuMA is a component of an insoluble matrix at mitotic spindle poles. *Cell Motil Cytoskeleton*, **42**, 189-203.

do Carmo Avides, M., Tavares, A. and Glover, D.M. (2001) Polo kinase and Asp are needed to promote the mitotic organizing activity of centrosomes. *Nat Cell Biol*, **3**, 421-424.

Doe, C.Q. and Bowerman, B. (2001) Asymmetric cell division: fly neuroblast meets worm zygote. *Curr Opin Cell Biol*, **13**, 68-75. positional information contributing towards orienting the spindle in budding yeast. Because the basic machinery orienting the spindle in higher-eukaryotic cells appears to be conserved, it might be expected that similar principles govern centrosome asymmetry in the course of metazoan development.

Dubochet, J.M., Lepault, A.J. and McDowell, A.W. (1985) Cryo-electron microscopy of vitrified biological specimen. *Trends Biochem. Sci.*, **10**, 143-146.

Evans, L., Mitchison, T.J. and Kirschner, M.W. (1985) Influence of the centrosome on the structure of nucleated microtubules. *J. Cell Biol.*, **100**, 1185-1191.

## Bibliography

---

Felix, M.A., Antony, C., Wright, M. and Maro, B. (1994) Centrosome assembly in vitro. *J. Cell Biol.*, **124**, 19-31.

Fleig, U., Salus, S.S., Karig, I. and Sazer, S. (2000) The fission yeast ran GTPase is required for microtubule integrity. *J Cell Biol*, **151**, 1101-1111.

Fornerod, M., Ohno, M., Yoshida, M. and Mattaj, I.W. (1997) CRM1 is an export receptor for leucine-rich nuclear export signals. *Cell*, **90**, 1051-1060.

Fygenson, D.K., Flyvbjerg, H., Sneppen, K., Libchaber, A. and Leibler, S. (1995) Spontaneous nucleation of microtubules. *Phys. Rev. Lett.*, **51**, 5058-5063.

Gaglio, T., Saredi, A., Bingham, J.B., Hasbani, M.J., Gill, S.R., Schroer, T.A. and Compton, D.A. (1996) Opposing motor activities are required for the organization of the mammalian mitotic spindle pole. *J Cell Biol*, **135**, 399-414.

Gaglio, T., Saredi, A. and Compton, D.A. (1995) NuMA is required for the organization of microtubules into aster-like mitotic arrays. *J Cell Biol*, **131**, 693-708.

Gallant, P. and Nigg, E.A. (1992) Cyclin B2 undergoes cell cycle-dependent nuclear translocation and, when expressed as a non-destructible mutant, causes mitotic arrest in HeLa cells. *J Cell Biol*, **117**, 213-224.

Garrett, S., Auer, K., Compton, D.A. and Kapoor, T.M. (2002) hTPX2 Is Required for Normal Spindle Morphology and Centrosome Integrity during Vertebrate Cell Division. *Curr Biol*, **12**, 2055-2059.

Giet, R. and Prigent, C. (2001) The non-catalytic domain of the *Xenopus laevis* auroraA kinase localises the protein to the centrosome. *J Cell Sci*, **114**, 2095-2104.

Gilchrist, D., Mykytka, B. and Rexach, M. (2002) Accelerating the rate of disassembly of karyopherin.cargo complexes. *J Biol Chem*, **277**, 18161-18172.

## Bibliography

---

Gorlich, D., Henklein, P., Laskey, R.A. and Hartmann, E. (1996a) A 41 amino acid motif in importin-alpha confers binding to importin- beta and hence transit into the nucleus. *Embo J*, **15**, 1810-1817.

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

Gorlich, D., Kraft, R., Kostka, S., Vogel, F., Hartmann, E., Laskey, R.A., Mattaj, I.W. and Izaurraide, E. (1996b) Importin provides a link between nuclear protein import and U snRNA export. *Cell*, **87**, 21-32.

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

Gorlich, D., Seewald, M.J. and Ribbeck, K. (2003) Characterization of Ran-driven cargo transport and the RanGTPase system by kinetic measurements and computer simulation. *Embo J*, **22**, 1088-1100.

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

Gruss, O.J., Carazo-Salas, R.E., Schatz, C.A., Guarguaglini, G., Kast, J., Wilm, M., Le Bot, N., Vernos, I., Karsenti, E. and Mattaj, I.W. (2001) Ran induces spindle assembly by reversing the inhibitory effect of importin alpha on TPX2 activity. *Cell*, **104**, 83-93.

Gruss, O.J., Wittmann, M., Yokoyama, H., Pepperkok, R., Kufer, T., Sillje, H., Karsenti, E., I.W., M. and Vernos, I. (2002) Chromosome-induced microtubule assembly mediated by TPX2 is required for spindle formation in HeLa cells. *Nat. Cell Biol.*, **in press**.

## Bibliography

---

Guarguaglini, G., Renzi, L., D'Ottavio, F., Di Fiore, B., Casenghi, M., Cundari, E. and Lavia, P. (2000) Regulated Ran-binding protein 1 activity is required for organization and function of the mitotic spindle in mammalian cells in vivo. *Cell Growth Differ*, **11**, 455-465.

Hannak, E., Kirkham, M., Hyman, A.A. and Oegema, K. (2001) Aurora-A kinase is required for centrosome maturation in *Caenorhabditis elegans*. *J Cell Biol*, **155**, 1109-1116.

Hannak, E., Oegema, K., Kirkham, M., Gonczy, P., Habermann, B. and Hyman, A.A. (2002) The kinetically dominant assembly pathway for centrosomal asters in *Caenorhabditis elegans* is gamma-tubulin dependent. *J Cell Biol*, **157**, 591-602.

Harreman, M.T., Hodel, M.R., Fanara, P., Hodel, A.E. and Corbett, A.H. (2002) The auto-inhibitory function of importin alpha is essential in vivo. *J Biol Chem*, **16**, 16.

Hartwell, L.H., Culotti, J., Pringle, J.R. and Reid, B.J. (1974) Genetic control of the cell division cycle in yeast. *Science*, **183**, 46-51.

Heald, R., Tournebize, R., Blank, T., Sandaltzopoulos, R., Becker, P., Hyman, A. and Karsenti, E. (1996) Self-organization of microtubules into bipolar spindles around artificial chromosomes in *Xenopus* egg extracts [see comments]. *Nature*, **382**, 420-425.

Heald, R., Tournebize, R., Habermann, A., Karsenti, E. and Hyman, A. (1997) Spindle assembly in *Xenopus* egg extracts: respective roles of centrosomes and microtubule self-organization. *J Cell Biol*, **138**, 615-628.

Heidebrecht, H.J., Buck, F., Steinmann, J., Sprenger, R., Wacker, H.H. and Parwaresch, R. (1997) p100: a novel proliferation-associated nuclear protein specifically restricted to cell cycle phases S, G2, and M. *Blood*, **90**, 226-233.

## Bibliography

---

Herold, A., Truant, R., Wiegand, H. and Cullen, B.R. (1998) Determination of the functional domain organization of the importin alpha nuclear import factor. *J Cell Biol*, **143**, 309-318.

Hinkle, B., Slepchenko, B., Rolls, M.M., Walther, T.C., Stein, P.A., Mehlmann, L.M., Ellenberg, J. and Terasaki, M. (2002) Chromosomal association of Ran during meiotic and mitotic divisions. *J Cell Sci*, **115**, 4685-4693.

Houliston, E., Le Guellec, R., Kress, M., Philippe, M. and Le Guellec, K. (1994) The kinesin-related protein Eg5 associates with both interphase and spindle microtubules during *Xenopus* early development. *Dev Biol*, **164**, 147-159.

Howard, A. and Pelc, S.R. (1953) Synthesis of deoxyribonucleic acid in normal and irradiated cells and its relation to chromosome breakage. *Heredity*, **6**, Supplement, 261-273.

Hyman, A., Drechsel, D., Kellogg, D., Salser, S., Sawin, K., Steffen, P., Wordeman, L. and Mitchison, T. (1991) Preparation of modified tubulins. *Methods in Enzymology*, **196**, 478-485.

Hyman, A.A. and Karsenti, E. (1996) Morphogenetic properties of microtubules and mitotic spindle assembly. *Cell*, **84**, 401-410.

Inoue, S. and Salmon, E.D. (1995) Force generation by microtubule assembly/disassembly in mitosis and related movements. *Mol Biol Cell*, **6**, 1619-1640.

Izaurralde, E., Kutay, U., von Kobbe, C., Mattaj, I.W. and Gorlich, D. (1997) The asymmetric distribution of the constituents of the Ran system is essential for transport into and out of the nucleus. *Embo J*, **16**, 6535-6547.

Jackman, M., Kubota, Y., den Elzen, N., Hagting, A. and Pines, J. (2002) Cyclin A- and cyclin E-Cdk complexes shuttle between the nucleus and the cytoplasm. *Mol Biol Cell*, **13**, 1030-1045.



## Bibliography

---

Jin, P., Gu, Y. and Morgan, D.O. (1996) Role of inhibitory CDC2 phosphorylation in radiation-induced G2 arrest in human cells. *J Cell Biol*, **134**, 963-970.

Jin, P., Hardy, S. and Morgan, D.O. (1998) Nuclear localization of cyclin B1 controls mitotic entry after DNA damage. *J Cell Biol*, **141**, 875-885.

Kalab, P., Pu, R.T. and Dasso, M. (1999) The ran GTPase regulates mitotic spindle assembly. *Curr Biol*, **9**, 481-484.

Kalab, P., Weis, K. and Heald, R. (2002) Visualization of a Ran-GTP gradient in interphase and mitotic *Xenopus* egg extracts. *Science*, **295**, 2452-2456.

Kalderon, D., Roberts, B.L., Richardson, W.D. and Smith, A.E. (1984) A short amino acid sequence able to specify nuclear location. *Cell*, **39**, 499-509.

Karsenti, E., Newport, J., Hubble, R. and Kirschner, M. (1984a) Interconversion of metaphase and interphase microtubule arrays, as studied by the injection of centrosomes and nuclei into *Xenopus* eggs. *J. Cell Biol.*, **98**, 1730-1745.

Karsenti, E., Newport, J. and Kirschner, M. (1984b) The respective roles of centrosomes and chromatin in the conversion of microtubule arrays from interphase to metaphase. *J. Cell Biol.*, **99**, 47s- 54s.

Kelly, L.M. and Gilliland, D.G. (2002) Genetics of myeloid leukemias. *Annu Rev Genomics Hum Genet*, **3**, 179-198.

Khodjakov, A., Cole, R.W., Oakley, B.R. and Rieder, C.L. (2000) Centrosome-independent mitotic spindle formation in vertebrates. *Curr Biol*, **10**, 59-67.

Khodjakov, A. and Rieder, C.L. (1999) The sudden recruitment of gamma-tubulin to the centrosome at the onset of mitosis and its dynamic exchange throughout the cell cycle, do not require microtubules. *J Cell Biol*, **146**, 585-596.

## Bibliography

---

Kirkpatrick, D. and Solomon, F. (1994) Overexpression of yeast homologs of the mammalian checkpoint gene *RCC1* suppresses the class of alpha-tubulin mutations that arrest with excess microtubules. *Genetics*, **137**, 381-392.

Kufer, T.A., Sillje, H.H., Korner, R., Gruss, O.J., Meraldi, P. and Nigg, E.A. (2002) Human TPX2 is required for targeting Aurora-A kinase to the spindle. *J Cell Biol*, **158**, 617-623.

Kuriyama, R., Gustus, C., Terada, Y., Uetake, Y. and Matuliene, J. (2002) CHO1, a mammalian kinesin-like protein, interacts with F-actin and is involved in the terminal phase of cytokinesis. *J Cell Biol*, **156**, 783-790.

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

Laemmli, U.K. (1970) Cleavage of structural proteins during the assembly of the head of bacteriophage T4. *Nature*, **227**, 680-685.

Lehner, C.F. and O'Farrell, P.H. (1990) *Drosophila cdc2* homologs: a functional homolog is coexpressed with a cognate variant. *Embo J*, **9**, 3573-3581.

Lohka, M.J., Hayes, M.K. and Maller, J.L. (1988) Purification of maturation - promoting factor, an intracellular regulator of early mitotic events. *Proc. Natl. Acad. Sci.*, **85**, 3009-3013.

Lohka, M.J. and Masui, Y. (1983) The germinal vesicle material required for sperm pronuclear formation is located in the soluble fraction of egg cytoplasm. *Exp Cell Res*, **148**, 481-491.

Maney, T., Ginkel, L.M., Hunter, A.W. and Wordeman, L. (2000) The kinetochore of higher eucaryotes: a molecular view. *Int Rev Cytol*, **194**, 67-131.

Matsumoto, T. and Beach, D. (1991) Premature initiation of mitosis in yeast lacking *RCC1* or an interacting GTPase. *Cell*, **66**, 347-360.

## Bibliography

---

Mattaj, I.W. and Englmeier, L. (1998) Nucleocytoplasmic transport: the soluble phase. *Annu Rev Biochem*, **67**, 265-306.

Mayer, T.U., Kapoor, T.M., Haggarty, S.J., King, R.W., Schreiber, S.L. and Mitchison, T.J. (1999) Small molecule inhibitor of mitotic spindle bipolarity identified in a phenotype-based screen. *Science*, **286**, 971-974.

Mazia, D. (1984) Centrosomes and mitotic poles. *Exp. Cell Res.*, **153**, 1-15.

McEwen, B.F., Heagle, A.B., Cassels, G.O., Buttle, K.F. and Rieder, C.L. (1997) Kinetochore fiber maturation in PtK1 cells and its implications for the mechanisms of chromosome congression and anaphase onset. *J Cell Biol*, **137**, 1567-1580.

Megraw, T.L., Kao, L.R. and Kaufman, T.C. (2001) Zygotic development without functional mitotic centrosomes. *Curr Biol*, **11**, 116-120.

Melchior, F., Paschal, B., Evans, J. and 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. *J Cell Biol*, **123**, 1649-1659.

Merdes, A., Ramyar, K., Vechio, J.D. and Cleveland, D.W. (1996) A complex of NuMA and cytoplasmic dynein is essential for mitotic spindle assembly. *Cell*, **87**, 447-458.

Minden, J.S., Agard, D.A., Sedat, J.W. and Alberts, B.M. (1989) Direct cell lineage analysis in *Drosophila melanogaster* by time-lapse, three-dimensional optical microscopy of living embryos. *J Cell Biol*, **109**, 505-516.

Mitchison, J.M. and Carter, B.L. (1975) Cell cycle analysis. *Methods Cell Biol*, **11**, 201-219.

Mitchison, T. and Kirschner, M. (1984a) Dynamic instability of microtubule growth. *Nature*, **312**, 237-242.

## Bibliography

---

Mitchison, T. and Kirschner, M. (1984b) Microtubule assembly nucleated by isolated centrosomes. *Nature*, **312**, 232-237.

Mitchison, T.J. (1989) Polewards microtubule flux in the mitotic spindle: evidence from photoactivation of fluorescence. *J Cell Biol*, **109**, 637-652.

Moore, J.D. (2001) The Ran-GTPase and cell-cycle control. *Bioessays*, **23**, 77-85.

Moore, M.S. and Blobel, G. (1993) The GTP-binding protein Ran/TC4 is required for protein import into the nucleus. *Nature*, **365**, 661-663.

Moore, M.S. and 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.

Moritz, M. and Agard, D.A. (2001) Gamma-tubulin complexes and microtubule nucleation. *Curr. Opin. Struct. Biol.*, **11**, 174-181.

Mountain, V., Simerly, C., Howard, L., Ando, A., Schatten, G. and Compton, D.A. (1999) The kinesin-related protein, HSET, opposes the activity of Eg5 and cross-links microtubules in the mammalian mitotic spindle. *J Cell Biol*, **147**, 351-366.

Murray, A. (1991) Cell cycle extracts. In Kay, B.K. and Peng, H.B. (eds.), *Xenopus laevis: Practical uses in cell and molecular biology*. Academic press, inc., San Diego New york Boston London Sydney Tokyo Toronto, Vol. 36, pp. 581-605.

Murray, A.W. and Kirschner, M.W. (1989) Cyclin synthesis drives the early embryonic cell cycle. *Nature*, **339**, 275-280.

Nachury, M.V., Maresca, T.J., Salmon, W.C., Waterman-Storer, C.M., Heald, R. and Weis, K. (2001) Importin beta Is a Mitotic Target of the Small GTPase Ran in Spindle Assembly. *Cell*, **104**, 95-106.

## Bibliography

---

Nedelec, F., Surrey, T. and Karsenti, E. (2003) Self-organisation and forces in the microtubule cytoskeleton. *Curr Opin Cell Biol*, **15**, 118-124. rapid MT growth, XMAP230 decreases the catastrophe frequency and XMAP310 increases the rescue frequency. This may have important implications for the regulation of MT dynamics during spindle morphogenesis and chromosome segregation.

Nishitani, H., Ohtsubo, M., Yamashita, K., Iida, H., Pines, J., Yasudo, H., Shibata, Y., Hunter, T. and Nishimoto, T. (1991) Loss of RCC1, a nuclear DNA-binding protein, uncouples the completion of DNA replication from the activation of cdc2 protein kinase and mitosis. *Embo J*, **10**, 1555-1564.

Oegema, K., Wiese, C., Martin, O.C., Milligan, R.A., Iwamatsu, A., Mitchison, T.J. and Zheng, Y. (1999) Characterization of two related Drosophila gamma-tubulin complexes that differ in their ability to nucleate microtubules. *J Cell Biol*, **144**, 721-733.

Ohba, T., Nakamura, M., Nishitani, H. and Nishimoto, T. (1999) Self-organization of microtubule asters induced in Xenopus egg extracts by GTP-bound Ran. *Science*, **284**, 1356-1358.

Ohta, K., Shiina, N., Okumura, E., Hisanaga, S., Kishimoto, T., Endo, S., Gotoh, Y., Nishida, E. and Sakai, H. (1993) Microtubule nucleating activity of centrosomes in cell-free extracts from Xenopus eggs: involvement of phosphorylation and accumulation of pericentriolar material. *J Cell Sci*, **104**, 125-137.

Ouspenski, I. (1998) A RanBP1 mutation which does not visibly affect nuclear import may reveal additional functions of the Ran GTPase system. *Exp Cell Res*, **244**, 171-183.

Ouspenski, I., Mueller, U.W., Matynia, A., Sazer, S., Elledge, S.J. and Brinkley, B.R. (1995) Ran-binding protein-1 is an essential component of the Ran/RCC1 molecular switch system in budding yeast. *J Biol Chem*, **270**, 1975-1978.

## Bibliography

---

Paoletti, A. and Bornens, M. (1997) Organisation and functional regulation of the centrosome in animal cells. *Prog Cell Cycle Res*, **3**, 285-299. 02115, USA. Karen.Omega@EMBL-Heidelberg.DE.

Paschal, B.M. and 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.

Popov, A., Severin, F. and Karsenti, E. (2002) XMAP215 is required for the microtubule-nucleating activity of centrosomes. *Curr. Biol.*, **12**, 1326-1330.

Reimann, J.D. and Jackson, P.K. (2002) Emi1 is required for cytostatic factor arrest in vertebrate eggs. *Nature*, **416**, 850-854.

Ren, M., Coutavas, E., D'Eustachio, P. and Rush, M.G. (1994) Effects of mutant Ran/TC4 proteins on cell cycle progression. *Mol Cell Biol*, **14**, 4216-4224.

Renault, L., Kuhlmann, J., Henkel, A. and Wittinghofer, A. (2001) Structural basis for guanine nucleotide exchange on Ran by the regulator of chromosome condensation (RCC1). *Cell*, **105**, 245-255.

Renault, L., Nassar, N., Vetter, I., Becker, J., Klebe, C., Roth, M. and Wittinghofer, A. (1998) The 1.7 Å crystal structure of the regulator of chromosome condensation (RCC1) reveals a seven-bladed propeller. *Nature*, **392**, 97-101.

Rexach, M. and Blobel, G. (1995) Protein import into nuclei: association and dissociation reactions involving transport substrate, transport factors, and nucleoporins. *Cell*, **83**, 683-692.

Ribbeck, K., Lipowsky, G., Kent, H.M., Stewart, M. and Gorlich, D. (1998) NTF2 mediates nuclear import of Ran. *Embo J*, **17**, 6587-6598.

Rieder, C. and Bajer, A.S. (1977) Heat-induced reversible hexagonal packing of spindle microtubules. *J Cell Biol*, **74**, 717-725.

## Bibliography

---

Rieder, C.L. and Borisy, G.G. (1981) The attachment of kinetochores to the pro-metaphase spindle in PtK1 cells. Recovery from low temperature treatment. *Chromosoma*, **82**, 693-716.

Rodionov, V.I. and Borisy, G.G. (1997) Self-centering activity of cytoplasm. *Nature*, **386**, 170-173.

Roghi, C., Giet, R., Uzbekov, R., Morin, N., Chartrain, I., Le Guellec, R., Couturier, A., Doree, M., Philippe, M. and Prigent, C. (1998) The *Xenopus* protein kinase pEg2 associates with the centrosome in a cell cycle-dependent manner, binds to the spindle microtubules and is involved in bipolar mitotic spindle assembly. *J Cell Sci*, **111**, 557-572.

Roof, D.M., Meluh, P.B. and Rose, M.D. (1992) Kinesin-related proteins required for assembly of the mitotic spindle. *J. Cell Biol.*, **118**, 95-108.

Sampaio, P., Rebollo, E., Varmark, H., Sunkel, C.E. and Gonzalez, C. (2001) Organized microtubule arrays in gamma-tubulin-depleted *Drosophila* spermatocytes. *Curr Biol*, **11**, 1788-1793.

Sawin, K.E. and Mitchison, T.J. (1991) Mitotic spindle assembly by two different pathways in vitro. *J Cell Biol*, **112**, 925-940.

Schiebel, E. (2000) gamma-tubulin complexes: binding to the centrosome, regulation and microtubule nucleation. *Curr. Opin. Cell Biol.*, **12**, 113-118.

Seewald, M.J., Korner, C., Wittinghofer, A. and Vetter, I.R. (2002) RanGAP mediates GTP hydrolysis without an arginine finger. *Nature*, **415**, 662-666.

Segal, M. and Bloom, K. (2001) Control of spindle polarity and orientation in *Saccharomyces cerevisiae*. *Trends Cell Biol*, **11**, 160-166. New York, Albany, 12201-10509, 12222, USA. khodj@wadsworth.org.

## Bibliography

---

Sellitto, C. and Kuriyama, R. (1988) Distribution of a matrix component of the midbody during the cell cycle in Chinese hamster ovary cells. *J Cell Biol*, **106**, 431-439.

Shamu, C.E. and Murray, A.W. (1992) Sister chromatid separation in frog egg extracts requires DNA topoisomerase II activity during anaphase. *J Cell Biol*, **117**, 921-934.

Sharp, D.J., Brown, H.M., Kwon, M., Rogers, G.C., Holland, G. and Scholey, J.M. (2000a) Functional coordination of three mitotic motors in *Drosophila* embryos. *Mol Biol Cell*, **11**, 241-253.

Sharp, D.J., Rogers, G.C. and Scholey, J.M. (2000b) Microtubule motors in mitosis. *Nature*, **407**, 41-47.

Stearns, T. and Kirschner, M. (1994) In vitro reconstitution of centrosome assembly and function: the central role of gamma-tubulin. *Cell*, **76**, 623-637.

Su, T.T., Sprenger, F., DiGregorio, P.J., Campbell, S.D. and O'Farrell, P.H. (1998) Exit from mitosis in *Drosophila* syncytial embryos requires proteolysis and cyclin degradation, and is associated with localized dephosphorylation. *Genes Dev*, **12**, 1495-1503.

Szollosi, D., Calarco, P. and Donahue, R.P. (1972) Absence of centrioles in the first and second meiotic spindles of mouse oocytes. *J. Cell Sci.*, **11**, 521-541.

Trinczek, B., Biernat, J., Baumann, K., Mandelkow, E.M. and Mandelkow, E. (1995) Domains of tau protein, differential phosphorylation, and dynamic instability of microtubules. *Mol Biol Cell*, **6**, 1887-1902.

Tsai, M.Y., Wiese, C., Cao, K., Martin, O., Donovan, P., Ruderman, J., Prigent, C. and Zheng, Y. (2003) A Ran signalling pathway mediated by the mitotic kinase Aurora A in spindle assembly. *Nat Cell Biol*, **10**, 10.



## Bibliography

---

Vale, R.D., Reese, T.S. and Scheetz, M.P. (1985) Identification of a novel force-generating protein, kinesin, involved in microtubule-based motility. *Cell*, **42**, 39-50.

Vasquez, R.J., Gard, D.L. and Cassimeris, L. (submitted) p34cdc2 phosphorylation reduces the microtubule-assembly promoting activity of XMAP215 but does not alter microtubule binding. *Mol. Biol. Cell*.

Vetter, I.R., Nowak, C., Nishimoto, T., Kuhlmann, J. and Wittinghofer, A. (1999) Structure of a Ran-binding domain complexed with Ran bound to a GTP analogue: implications for nuclear transport. *Nature*, **398**, 39-46.

Wakefield, J.G., Bonaccorsi, S. and Gatti, M. (2001) The drosophila protein asp is involved in microtubule organization during spindle formation and cytokinesis. *J Cell Biol*, **153**, 637-648.

Walczak, C., Mitchison, T.J. and Desai, A.B. (1996a) XKCM1: A Xenopus kinesin-related protein that regulates microtubule dynamics during mitotic spindle assembly. *Cell*, **84**, 37-47.

Walczak, C.E., Gan, E.C., Desai, A., Mitchison, T.J. and Kline-Smith, S.L. (2002) The microtubule-destabilizing kinesin XKCM1 is required for chromosome positioning during spindle assembly. *Curr Biol*, **12**, 1885-1889.

Walczak, C.E. and Mitchison, T.J. (1996) Kinesin-related proteins at mitotic spindle poles: function and regulation. *Cell*, **85**, 943-946. mitoses. This inference can be reconciled with the failure to observe oscillations in total cyclin levels if only a small pool of cyclins is destroyed in each cycle. We find that antibody detection of histone H943 phosphorylation (PH943) acts as a reporter for Cdk941 activity. A gradient of PH943 along anaphase chromosomes suggests local Cdk941 inactivation near the spindle poles in syncytial embryos. This pattern of Cdk941 inactivation would be consistent with local cyclin destruction at centrosomes or kinetochores. The local loss of PH943 during anaphase is specific to the syncytial divisions and is not observed after cellularization. We

## Bibliography

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suggest that exit from mitosis in syncytial cycles is modified to allow nuclear autonomy within a common cytoplasm.

Walczak, C.E., Mitchison, T.J. and Desai, A. (1996b) XKCM1: a *Xenopus* kinesin-related protein that regulates microtubule dynamics during mitotic spindle assembly. *Cell*, **84**, 37-47.

Walczak, C.E., Verma, S. and Mitchison, T.J. (1997) XCTK2: a kinesin-related protein that promotes mitotic spindle assembly in *Xenopus laevis* egg extracts. *J Cell Biol*, **136**, 859-870.

Walczak, C.E., Vernos, I., Mitchison, T.J., Karsenti, E. and Heald, R. (1998) A model for the proposed roles of different microtubule-based motor proteins in establishing spindle bipolarity. *Curr Biol*, **8**, 903-913.

Walker, R.A., O'brien, E.T., Pryer, N.K., Sobeiro, M.F., Voter, W.A., Erickson, H.P. and Salmon, E.D. (1988) Dynamic instability of individual microtubules analyzed by video light microscopy: rate constants and transition frequencies. *J. Cell Biol.*, **107**, 1437-1448.

Waterman-Storer, C.M., Desai, A., Bulinski, J.C. and Salmon, E.D. (1998) Fluorescent speckle microscopy, a method to visualize the dynamics of protein assemblies in living cells. *Curr Biol*, **8**, 1227-1230. phosphorylation are on the rates of tubulin dissociation and catastrophe whereas the effects on the rates of association or rescue are comparatively small.

Waterman-Storer, C.M. and Salmon, E.D. (1997) Actomyosin-based retrograde flow of microtubules in the lamella of migrating epithelial cells influences microtubule dynamic instability an turnover and associated with microtubule breakage and treadmilling. *J. Cell Biol.*, **139**, 1-18.

Weis, K., Dingwall, C. and Lamond, A.I. (1996) Characterization of the nuclear protein import mechanism using Ran mutants with altered nucleotide binding specificities. *Embo J*, **15**, 7120-7128.

## Bibliography

---

Weisenberg, R.C. (1972) Microtubule formation in vitro in solutions containing low calcium concentrations. *Science*, **177**, 1104-1105. not only associates with the minus ends of microtubules at the acentriolar poles but also with the central spindle pole body that forms between the two tandem spindles of meiosis II. Upon fertilisation, Asp is also recruited to the MTOC that nucleates the sperm aster. Asp is required for growth of the microtubules of the sperm aster, which in asp mutants remains diminutive and so prevents migration of the pronuclei.

Wiese, C., Wilde, A., Moore, M.S., Adam, S.A., Merdes, A. and Zheng, Y. (2001) Role of Importin- $\beta$  in Coupling Ran to Downstream Targets in Microtubule Assembly. *Science*, **4**, 4.

Wilde, A., Lizarraga, S.B., Zhang, L., Wiese, C., Gliksman, N.R., Walczak, C.E. and Zheng, Y. (2001) Ran stimulates spindle assembly by altering microtubule dynamics and the balance of motor activities. *Nat Cell Biol*, **3**, 221-227.

Wilde, A. and Zheng, Y. (1999) Stimulation of microtubule aster formation and spindle assembly by the small GTPase Ran. *Science*, **284**, 1359-1362.

Wittmann, T., Boleti, H., Antony, C., Karsenti, E. and Vernos, I. (1998) Localization of the kinesin-like protein Xklp2 to spindle poles requires a leucine zipper, a microtubule-associated protein, and dynein. *J Cell Biol*, **143**, 673-685.

Wittmann, T., Wilm, M., Karsenti, E. and Vernos, I. (2000) TPX2, A novel xenopus MAP involved in spindle pole organization. *J Cell Biol*, **149**, 1405-1418.

Zhang, C., Hughes, M. and Clarke, P.R. (1999) Ran-GTP stabilises microtubule asters and inhibits nuclear assembly in *Xenopus* egg extracts. *J Cell Sci*, **112 ( Pt 14)**, 2453-2461.

Zheng, Y., Wong, M.L., Alberts, B. and Mitchison, T. (1995) Nucleation of microtubule assembly by a gamma-tubulin-containing ring complex. *Nature*, **378**, 578-583. budding yeast. Because the basic machinery orienting the spindle in higher-eukaryotic cells appears to be conserved, it might be expected that similar

## Bibliography

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principles govern centrosome asymmetry in the course of metazoan development.

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## Publications

**Schatz, C.A.**, Santarella, R., Hönger, A., Karsenti, E., Mattaj, I. W., Gruss, O. J. & Carazo-Salas, R. E. (2003) EMBO, in press.

Gruss, O. J., Carazo-Salas, R. E., **Schatz, C. A.**, Guarguaglini, G., Kast, J., Wilm, M., Le Bot, N., Vernos, I., Karsenti, E. & Mattaj, I. W. (2001) *Cell* **104**, 83-93.

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