Zytoskelett, cytosceleton

Das **Zytoskelett** (altgriechisch κύτος kýtos – „Zelle“) (auch Cytoskelett oder Zellskelett, Cytobones, Cytonerves (De Duve) http://www.erlebnishaft.de/selbst_muster_nano.pdf http://www.erlebnishaft.de/symbiogenese.pdf) ist ein dynamisches, aus Proteinen bestehendes Netzwerk im Zell-Plasma.
Quelle: http://de.wikipedia.org/wiki/Zytoskelett http://en.wikipedia.org/wiki/Cytoskeleton

The **cytoskeleton** (ancient Greek κύτος kytos - "cell") (also cytoskeleton or cytoskeleton, Cytobones, Cytonerves (De Duve) http://www.erlebnishaft.de/selbst_muster_nano.pdf http://www.erlebnishaft.de/symbiogenese.pdf) is a dynamic network consisting of proteins in the cell plasma.

- ➔ Kopfhirn, Bauchhirn, Intelligenz der körpereigenen, nichtneuronalen Zellen, Intelligenz der Bakterien, Pilze, Protozoen und Würmer.
- ➔ Head brain, gut brain, the intelligence the own non-euro-neuronal cells, the intelligence of bacteria, fungi, protozoa and nematoda.

Cytoskeletal defects http://en.wikipedia.org/wiki/Category:Cytoskeletal_defects
Defects of cell structure http://en.wikipedia.org/wiki/Category:Defects_of_cell_structure

---

„Leben ist nur ein Elektron auf der Suche nach einem Ruheplatz.
Life is but an electron looking for a place to rest”. (Albert Szent- Giörgyi).

Popp FA. Das Licht des Lebens http://www.broeckers.com/Popp.htm

Stossel TP (1989) From signal to pseudopod. How cells control cytoplasmic actin assembly. J Biol Chem 264, 18261-18264.
https://www.researchgate.net/publication/20475425_From_Signal_to_Pseudopod_How_cells_control_cytoplasmic_actin_assembly

de Boer P, Crossley R, Rothfield L (1992) The essential bacterial cell division protein FtsZ is a GTPase. Nature (London) 359, 254-256. https://www.ncbi.nlm.nih.gov/pubmed/1528268

Erickson HP (1995) FtsZ, a prokaryotic homolog of tubulin? Cell 80, 367–370.
http://www.cell.com/cell/abstract/0092-8674(95)90486-7

Keeling PJ and Doolittle WF(1996) Alpha-tubulin from early diverging eukaryotic lineages and the evolution of the tubulin family. Mol Biol Evol, 13 (10), 1297 –1305.
https://www.ncbi.nlm.nih.gov/pubmed/8952074

Nogales E, Wolf SG, Downing KH (1998) Structure of the alpha beta tubulin dimer by electron crystallography. Nature 391, 199–203.
https://www.ncbi.nlm.nih.gov/pubmed/9428769
http://www2.mrc-lmb.cam.ac.uk/groups/JYL/PDF/nsb1998.pdf

Nogales E, Downing KH, Amos LA, Löwe J (1998) Tubulin and FtsZ form a distinct family of GTPases. Nat Struct Biol 5, 451–458.
http://www.nature.com/nsmb/journal/v5/n6/abs/nsb0698-451.html

Hoppert M, Mayer F (1999) Principles of Macromolecular Organization and Cell Functionin Bacteria and Archeae. Cell Biochem Biophys 31(3), 247-284 http://www.ncbi.nlm.nih.gov/pubmed/10736750

Tokuraku,K., M.Katsuki, T.Matui, et al. (1999) Microtubule-binding property of microtubule-associated protein 2 differs from that of microtubule-associated protein 4 and tau. Eur. J. Biochem. 264:996-1001.

McMurray CT (2000) **Neurodegeneration:** diseases of the cytoskeleton? Cell Death & Differentiation 7(10), 861-865 [PDF] http://www.nature.com/cdd/journal/v7/n10/full/4400764a.html

Srivatava,R.K., M.P.Mattson, and D.L.Longo. (2001) **Cytoskeletal Involvement in Apoptosis**. In Programmed cell death, Volume 1. M.P.Mattson, S.Estus, and V.Rangnekar, ed. Elsevier, Amsterdam; London; New York; Oxford; Paris; Shannon; Tokio. 237-267.

Van den Ent F, Amos L, Löwe J (2001) **Bacterial ancestry of actin and tubulin**. Current Opinion in Microbiology. 4, 634-638 http://www.ncbi.nlm.nih.gov/pubmed/11731313

van den Ent F, Löwe J (2001) **Prokaryotic origin of the actin cytoskeleton**. Nature 413, 39–44 Article PubMed ISI ChemPort

Coulombe,P.A., L.Ma, S.Yamada, and M.Wawersik. (2001) Intermediate filaments at a glance. J. Cell Sci. 114:4345-4347.

Jones, LJ, Carballido-López R, Errington J (2001) Control of cell shape in bacteria: helical, **actin-like filaments in Bacillus subtilis**. Cell 104, 913–922 Article PubMed ISI ChemPort

Hegermann J, Herrmann R, Mayer F (2002) **Cytoskeletal elements in the bacterium Mycoplasma pneumoniae.** Naturwissenschaften 89(10), 453-8. DOI:10.1007/s00114-002-0359-2

Lida,J., T.J.Itoh, H.Hotani, K.Nishiyama, H.Murofushi, J.C.Bulinski, and S.Hisanaga. (2002) The projection domain of MAP4 suppresses the microtubule-bundling activity of the microtubule-binding domain. J. Mol. Biol. 320:97-106.

Howard J, Hyman AA (2003) **Dynamics and mechanics of the microtubule plus end.** Journal:Nature 422, 753-758; doi:10.1038/nature01600. Abstract | Full text | PDF (976KB)
« An important function of microtubules is to move cellular structures such as chromosomes, mitotic spindles and other organelles around inside cells. This is achieved by attaching the ends of microtubules to cellular structures; as the microtubules grow and shrink, the structures are pushed or pulled around the cell. … It is now clear that there are at least three properties of a microtubule end: it has alternate structures; it has a biochemical transition defined by GTP hydrolysis; and it forms a distinct target for the binding of specific proteins. These different properties can be unified by thinking of the microtubule as a molecular machine, which switches between growing and shrinking modes. Each mode is associated with a specific end structure on which end-binding proteins can assemble to modulate dynamics and couple the dynamic properties of microtubules to the movement of cellular structures. »

Lodish,H., A.Berk, P.Matsudaira, C.A.Kaiser, et al. (2003) Molecular cell biology. W.H.Freeman, New York.

Hurd T, Gao L, Roh MH et al. (2003) **Direct interaction of two polarity complexes implicated in epithelial tight junction assembly.** Nat Cell Biol. 5, 137-42 (Cited in 81 papers, Hist Cite Analysis) http://www.ncbi.nlm.nih.gov/pubmed/12545177

Manneville S, Hall A (2003) **Cdc42 regulates GSK-3β and adenomatous polyposis coli to control cell polarit.** *Etienne-* Nature. 421, 753-6 (Cited in 111 papers, Hist Cite Analysis) http://www.ncbi.nlm.nih.gov/pubmed/12610628
«We conclude that Cdc42 regulates cell polarity through the spatial regulation of GSK-3beta and Apc. This role for Apc may contribute to its tumour-suppressor activity. «

Mayer F (2003) **Cytoskeletons in prokaryotes. Status report and hypotheses**. Cell Biology International 27, 429–438 http://www.cellbiolint.org/cbi/027/0429/0270429.pdf http://www.ncbi.nlm.nih.gov/pubmed/12758091

Mayer F, Gottschalk G (2003) Article: The bacterial cytoskeleton and its putative role in membrane vesicle formation observed in a Gram-positive bacterium producing starch-degrading enzymes. Journal of Molecular Microbiology and Biotechnology 6(3-4), 127-32. [Show abstract]

Vaughan S, Wickstead B, Gull K, Addinall SG (2004) Molecular evolution of FtsZ protein sequences encoded within the genomes of archaea, bacteria, and eukaryota. J Mol Evol 58, 19–29. https://www.ncbi.nlm.nih.gov/pubmed/14743312

Mayer F. (2005) Chapter: **Cytoskeletons in Eukaryotes and Prokaryotes** SBN: 9783527600038

Margolin W (2005) FtsZ and the division of prokaryotic cells and organelles. Nat Rev Mol Cell Biol 6, 862–871. https://www.ncbi.nlm.nih.gov/pubmed/16227976

Mayer F (2006) Cytoskeletal elements in bacteria Mycoplasma pneumoniae, Thermoanaerobacterium sp., and Escherichia coli as revealed by electron microscopy. Journal of Molecular Microbiology and Biotechnology (Impact Factor: 1.68). 11(3-5), 228-43. DOI:10.1159/000094057 Source: PubMed
„ABSTRACT Recently, electron microscopic studies on the eubacteria Mycoplasma pneumoniae, Thermoanaerobacterium sp., and Escherichia coli have revealed the existence of cytoskeletal elements so far unknown in prokaryotes. … A feature that is common to both bacteria and to Thermoanaerobacterium sp. appears to be that the lining and the fibrils crossing the cytoplasm contain a high number of copies of the bacterial elongation factor Tu (EF-Tu). This indicates that this protein may play an important role as a structural element in bacterial cytoskeletons. This notion was supported by experiments in which the cytoskeleton in E. coli was destabilized by induced expression of truncated EF-Tu, with the consequence of cell lysis, and by the finding that in vitro polymerization of monomeric EF-Tu into protofilaments was hindered in a mixture of full-size EF-Tu and truncated EF-Tu consisting of domain 3 only. Current research and developmental efforts are aimed at the design of a new class of antibacterial drugs, acting by destabilization of the EF-Tu-containing bacterial cytoskeleton, and of an innovative mode of inducible lysis of recombinant bacteria by controlled destabilization of the EF-Tu-containing cytoskeleton".

Alliegro MC, Alliegro MA, Palazzo RE. (2006) **Centrosome-associated RNA** in surf clam oocytes. Proc Natl Acad Sci U S A. 103(24),9034-8. http://www.ncbi.nlm.nih.gov/pubmed/16754862

Shih YL, Rothfield L (2006) **The Bacterial Cytoskeleton**. MICROBIOLOGY AND MOLECULAR BIOLOGY REVIEWS 70(3) 729–754 1092-2172/06/$08.00 0 doi:10.1128/MMBR.00017-06 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1594594/pdf/0017-06.pdf http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1594594/

Carballido-Lopez R (2006) **The Bacterial Actin-Like Cytoskeleton**. MICROBIOLOGY AND MOLECULAR BIOLOGY REVIEWS, 70(4) 888–909 1092-2172/06/$08.000 oi:10.1128/MMBR.00014-06 American Society for Microbiology.
https://www.researchgate.net/publication/6640408_The_bacterial_actin-like_cytoskeleton?ch=reg&cp=re254_x_p5&pli=1&loginT=Sake82IkoFpOCWNNjL50_OC4sNJLVVvzM09EBInP7FI,

Chhabra ES, Higgs HN (2007) **The many faces of actin: matching assembly factors with cellular structures** Journal:Nature Cell Biology 95, 1110-1121 Abstract | Full text | PDF (689KB)
« Here, we focus on structures at the plasma membrane, including both sheet-like protrusive structures (such as lamellipodia and ruffles) and finger-like protrusions (such as filopodia and microvilli) ».

Herrmann H, Bär H, Kreplak L et al. (2007) **Intermediate filaments: from cell architecture to nanomechanics.** Journal:Nature Reviews Molecular Cell Biology 8, 562-573 Abstract | Full text | PDF (838KB)
« Intermediate filaments (IFs) constitute a major structural element of animal cells. They build two distinct systems, one in the nucleus and one in the cytoplasm. In both cases, their major function is assumed to be that of a mechanical stress absorber and an integrating device for the entire cytoskeleton. In line with this, recent disease mutations in human IF proteins indicate that the nanomechanical properties of cell-type-specific IFs are central to the pathogenesis of diseases as diverse as muscular dystrophy and premature ageing. However, the analysis of these various diseases suggests that IFs also have an important role in cell-type-specific physiological functions. »

Erickson HP (2007) **Evolution of the cytoskeleton**. Bioessays 29(7), 668–677. doi:10.1002/bies.20601 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2630885/pdf/nihms-86039.pdf

Vats P, Rothfield L (2007) Duplication and segregation of the actin (MreB) cytoskeleton during the prokaryotic cell cycle. PNAS 104(45) 17795–17800 http://www.pnas.org/content/104/45/17795.full.pdf

Madkour MH, Mayer F. (2007) **Intracellular cytoskeletal elements and cytoskeletons in bacteria**. Sci Prog. 90(Pt 2-3), 73-102. http://www.ncbi.nlm.nih.gov/pubmed/17725228 https://www.researchgate.net/publication/6115555_Intracellular_cytoskeletal_elements_and_cytoskeletons_in_bacteria?ch=reg&cp=re217_x_p2&pli=1&loginT=x9_QQzbBk3plVq70XLN_7k_PWg9Lygin6LflQECCQRI,
„Homologs of eukaryotic actin, tubulin, and intermediate filaments were found in bacteria; cytoskeletal proteins not closely or not at all related to any of these major cytoskeletal proteins were discovered in a number of bacteria such as Mycoplasmas, Spiroplasmas, Spirochetes, Treponema, Caulobacter. A structural role for bacterial elongation factor Tu was indicated. On the basis of this new thinking, new approaches in biotechnology and new drugs are on the way."

Milestone 21, (1992-1998) (2008) **Discovery of the bacterial cytoskeleton. The prokaryotic cytoskeleton**. Deepa Nath, Senior Editor, Nature, doi:10.1038/nrm2582 http://www.nature.com/milestones/milecyto/full/milecyto21.html
"In **2001**, two papers by van den Ent et al. and Jones et al. demonstrated that MreB is the bacterial homologue of eukaryotic actin. Based on sequence similarities, **actin belongs to a large superfamily of proteins of unrelated function that includes the chaperone heat-shock protein-70 (Hsp70)**".

Lill R. (2007/08) **Das Zytoskelett**. http://www.uni-marburg.de/fb20/cyto/lehre/medi1/zytoskelett

Popp FA (2008) **Quantenmedizin** http://www.amazon.de/Licht-Leben-Lebensprozesse-Biophotonen-Analytik-Quantenmedizin/dp/B001CM5WWQ

Wier AM., Sacchi L. Dolan MF. Bandi C., Macallister J. Margulis L. (2010) **Spirochete attachment ultrastructure**: implications for the origin and evolution of cilia. (Report) The Biological Bulletin http://www.highbeam.com/doc/1G1-222229087.html

Alliegro MA, Henry, JA., Alliegro MC. (2010) **Rediscovery of the nucleolinus, a dynamic RNA-rich organelle associated with the nucleolus, spindle, and centrosomes**. Proc Natl Acad Sci U S A. 107(31), 13718–13723. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2922224/

Noree C., Sato BK, Boyer RM et al. (2010) Identification of novel filament-forming proteins in Saccharomyces cerevisiae and Drosophila melanogaster. JCB vol. 190 no. 4 541-551 http://jcb.rupress.org/content/190/4/541.full

Trewavas AJ, Baluska F (2011) **The ubiquity of consciousness. The ubiquity of consciousness, cognition and intelligence in life.** EMBO Rep 12(12), 1221–1225. doi: 10.1038/embor.2011.218.

GASPER R, LÖWE J (2011) Zytologie. **Das bakterielle Zytoskelett**. **BIO***spektrum* 17. Jahrgang. http://www2.mrc-lmb.cam.ac.uk/groups/jyl/pdf/Biospektrum2011%20Gasper.pdf

Wickstead B, Gull K (2011) **The evolution of the cytoskeleton**. JCB 194(4) 513-525 The Rockefeller University Press, doi: 10.1083/jcb.201102065 http://jcb.rupress.org/content/194/4/513.full

Pilhofer M, Ladinsky MS, McDowall AW, Petroni G, Jensen GJ (2011) **Microtubules in Bacteria: Ancient Tubulins Build a Five-Protofilament Homolog of the Eukaryotic Cytoskeleton**. PLoS Biol 9(12). https://www.ncbi.nlm.nih.gov/pubmed/22162949

Alliegro MC. (2011) **The Nucleolinus**. A disappearing, forgotten and (maybe) misnamed organelle. Commun Integr Biol. 4(2): 147–149. http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3104566/

Amos LA. (2011) **What tubulin drugs tell us about microtubule structure and dynamics.** Semin Cell Dev Biol. 22(9), 916-26. doi: 10.1016/j.semcdb.2011.09.014. Epub 2011 Oct 5. http://www.ncbi.nlm.nih.gov/pubmed/22001382
http://www.researchgate.net/publication/51719194_What_tubulin_drugs_tell_us_about_microtubule_structure_and_dynamics

Chen L, Rolls MM (2012) Microtubule deacetylation sets the stage for successful axon regeneration. EMBO J 31(14), 3033-5. Full Citation

Wu QF, Yang L, Li S, et al. (2012) **Fibroblast growth factor 13** is a microtubule-stabilizing protein regulating neuronal polarization and migration. Cell 2012 149(7), 1549-64. Abstract

Diduk SV, Smirnova KV, Gurtsevich VE (2012) The influence of point mutations in the **Epstein-Barr virus** LMP1 oncogene on the cell cytoskeleton and activation of inducible form of NO synthase. Vestn Ross Akad Med Nauk (3), 62-7. Abstract | Full Citation

(2012) Abstracts of the All Russian Conference 'Intracellular Signaling, Transport, Cytoskeleton', October 11-13, 2011, St Petersburg, Russia]. Tsitologiia 54(1), 89-101. Full Citation

Khodjakov A, Khodjakov A (2012) Diving into the mitotic apparatus. Interview by Caitlin Sedwick. J Cell Biol 197(6), 694-5. Full Citation

Muthukumaran P, Lim CT, Lee T (2012) **Estradiol influences** the mechanical properties of human fetal osteoblasts through **cytoskeletal changes**. Biochem Biophys Res Commun 423(3), 503-8. Abstract

Goldmann WH (2012) **Mechanotransduction in cells**. Cell Biol Int 36(6), 567-70. Abstract

Kinoshita M (2012) Role of septin cytoskeleton in dopaminergic neurotransmission and neurodegeneration. Nihon Shinkei Seishin Yakurigaku Zasshi 32(1), 25-9. Abstract

Spindler KR, Hsu TH (2012) **Viral disruption of the blood-brain barrier.** Trends Microbiol 20(6), 282-90. Abstract

Jeyaprakash AA, Santamaria A, Jayachandran U, et al. (2012) **Structural and functional organization of the Ska complex, a key component of the kinetochore-microtubule interface.** Mol Cell 46(3), 274-86. Abstract

Lee G, Leugers CJ (2012) **Tau and tauopathies**. Prog Mol Biol Transl Sci 263-93. Abstract

Trescos Y, Tournier JN (2012) Cytoskeleton as an emerging target of anthrax toxins. Toxins (Basel) 4(2), 83-97. Abstract

Mardin BR, Schiebel E (2012) Breaking the ties that bind: new advances in **centrosome biology**. J Cell Biol 197(1), 11-8. Abstract

Zhang B, Carroll J, Trojanowski JQ, et al. (2012) The microtubule-stabilizing agent, **epothilone D**, reduces axonal dysfunction, neurotoxicity, cognitive deficits, and Alzheimer-like pathology in an interventional study with aged tau transgenic mice. J Neurosci 32(11), 3601-11. Abstract

Adikes RC, Unrath WC, Yengo CM et al. (2013) Biochemical and Bioinformatic Analysis of the **Myosin-XIX Motor Domain**. Cytoskeleton, 70,281–295 (doi: 10.1002/cm.21110) http://onlinelibrary.wiley.com/doi/10.1002/cm.21110/pdf

Sahu S, Ghosh S, Hirata K, Fujita D, Bandyopadhyay A (2013**) Multi level memory switching properties of a single brain microtubule.** Appl Phys Lett 102, 123701.

Feric M, Brangwynne CP (2013) A **nuclear F-actin scaffold** stabilizes ribonucleoprotein droplets against gravity in large cells. Nature Cell Biology 15, 1253–1259 doi:10.1038/ncb2830 http://www.nature.com/ncb/journal/v15/n10/full/ncb2830.html

Craddock TJ, Friesen D, Mane J, Hameroff S, Tuszynski JA (2014) **The feasibility of coherent energy transfer in microtubules.** J R Soc Interface. 11(100), 20140677. doi: 10.1098/rsif.2014.0677. https://www.ncbi.nlm.nih.gov/pubmed/25232047

Amos LA, Löwe J. (2014) **The subtle allostery of microtubule dynamics.** Nat Struct Mol Biol. 21(6), 505-6. doi: 10.1038/nsmb.2836.http://www.ncbi.nlm.nih.gov/pubmed/24896811

Duggin IG, Aylett CHS, Walsch JC et al. (2014) Letter. **CetZ tubulin-like proteins control archaeal cell shape**. doi: 10.1038/nature13983. http://www.ncbi.nlm.nih.gov/pubmed/25533961
"Our findings expand the known roles of the FtsZ/tubulin superfamily to include archaeal cell shape dynamics, suggesting that a cytoskeletal role might predate eukaryotic cell evolution, and they support the premise that a major function of the microbial rod shape is to facilitate swimming".

Mayer F (2015) **Role of Elongation Factor EF-Tu in Bacterial Cytoskeletons** – Mini Review and Update. Swift Journal of Medicine and Medical Sciences 1(2), 06-11. https://www.researchgate.net/publication/277715418_Role_of_elongation_factor_EF-Tu_in_bacterial_cytoskeletons_-_mini_review_and_update
http://www.swiftjournals.org/sjmms/abstract/2015/september/Mayer.php

Gunning PW, Ghoshdastider U, Whitaker S, Popp D, Robinson RC (2015) **The evolution of compositionally and functionally distinct actin filaments**. J Cell Sci doi:10.1242/jcs.165563. http://jcs.biologists.org/content/128/11/2009

Pereira C (2015) **Cytoskeleton and Consciousness: An Evolutionary Based Review**. Neuro Quantology 13 (2), 232-239. . DOI: 10.14704/nq.2015.13.2.842. http://www.neuroquantology.com/index.php/journal/article/view/842/710

Seneff S (2017) **The Mineral Power for Your Body's Electrical Supply.** TEDxNewYorkSalon https://www.youtube.com/watch?v=fDWEVXhaydc

Videos:
Microtubules (2015) https://www.youtube.com/watch?v=-qV__tYb4c4

http://www.youtube.com/watch?v=5rqbmLiSkpk
http://www.youtube.com/watch?v=aG78PNwcqO8&feature=related

http://www.youtube.com/watch?v=9ICqcZ99qGk&feature=related
http://www.youtube.com/watch?NR=1&v=9iXoXzgmEXw&feature=endscreen

The Future of Consciousness: Stuart Hameroff at TEDxTucson
http://www.youtube.com/watch?v=1d5RetvkkuQ
TEDx Brussels 2010 - Stuart Hameroff - Do we have a quantum Soul?
http://www.youtube.com/watch?v=iIyEjh6ef_8

Hameroff S. (2014) Dissecting Consciousness. Theoretical physicist Michio Kaku describes his new theory of consciousness.
http://www.the-scientist.com//?articles.view/articleNo/39596/title/Dissecting-Consciousness/

- **Selbstorganisation** http://www.erlebnishaft.de/selbst_muster_nano.pdf
- **Symbiogenese** http://www.erlebnishaft.de/symbiogenese.pdf
- **Immunologie** http://www.erlebnishaft.de/danger_model.pdf

- Lynn Margulis, Dorion Sagan (1986) **Microcosmos.** pp 137-154: The Symbiotic Brain ISBN 0-520-21064-6
- **Warum Borrelien infektös bleiben trotz intensiver antibiotischer Behandlung** http://www.xerlebnishaft.de/escape.pdf
- **Why Borrelia remain infectious despite intensive antibiotic treatment** http://www.xerlebnishaft.de/escape_eng.pdf

- **Mitochondrien** http://www.xerlebnishaft.de/mitochondrien.pdf
- **Krebsstammzelltherapie** http://www.xerlebnishaft.de/krebsstammzelltherapie.pdf

- **Cavete Diagnosen** http://www.erlebnishaft.de/kommentalternativ.pdf

Back to top: http://www.xerlebnishaft.de/zytoskelett.pdf