

- Cheng, X. J., and Tachibana, H. (2001). Protection of hamsters from amebic liver abscess formation by immunization with the 150- and 170-kDa surface antigens of *Entamoeba histolytica*. *Parasitol. Res.* **87**, 126–130.
- Chi, A., and Kemp, R. G. (2000). The primordial high energy compound: ATP or inorganic pyrophosphate? *J. Biol. Chem.* **275**, 35677–35679.
- Chi, A. S., Deng, Z., Albach, R. A., and Kemp, R. G. (2001). The two phosphofructokinase gene products of *Entamoeba histolytica*. *J. Biol. Chem.* **276**, 19974–19981.
- Chinkers, M. (2001). Protein phosphatase 5 in signal transduction. *Trends Endocrinol. Metab.* **12**, 28–32.
- Clark, C. G., and Roger, A. J. (1995). Direct evidence for secondary loss of mitochondria in *Entamoeba histolytica*. *Proc. Natl. Acad. Sci. USA* **92**, 6518–6521.
- Clark, C. G., Espinosa Cantellano, M., and Bhattacharya, A. (2000). *Entamoeba histolytica*: An overview of the biology of the organism. In "Amebiasis" (J. I. Ravdin, ed.), pp. 1–45. Imperial College Press, London.
- Clark, C. G., Ali, I. K., Zaki, M., Loftus, B. J., and Hall, N. (2006a). Unique organisation of tRNA genes in *Entamoeba histolytica*. *Mol. Biochem. Parasitol.* **146**, 24–29.
- Clark, C. G., Kaffashian, F., Tawari, B., Windsor, J. J., Twigg-Flesner, A., Davies-Morel, M. C. G., Blessmann, J., Ebert, F., Peschel, B., Le Van, A., Jackson, C. J., Macfarlane, L., et al. (2006b). New insights into the phylogeny of *Entamoeba* species provided by analysis of four new small-subunit rRNA genes. *Int. J. Syst. Evol. Microbiol.* **56**, 2235–2239.
- Clary, D. O., Griff, I. C., and Rothman, J. E. (1990). SNAPs, a family of NSF attachment proteins involved in intracellular membrane fusion in animals and yeast. *Cell* **61**, 709–721.
- Conner, S. D., and Schmid, S. L. (2003). Differential requirements for AP-2 in clathrin-mediated endocytosis. *J. Cell Biol.* **162**, 773–779.
- Coombs, G. H., and Mottram, J. C. (2001). Trifluoromethionine, a prodrug designed against methionine gamma-lyase-containing pathogens, has efficacy *in vitro* and *in vivo* against *Trichomonas vaginalis*. *Antimicrob. Agents Chemother.* **45**, 1743–1745.
- Coppi, A., and Eichinger, D. (1999). Regulation of *Entamoeba invadens* encystation and gene expression with galactose and N-acetylglucosamine. *Mol. Biochem. Parasitol.* **102**, 67–77.
- Coppi, A., Merali, S., and Eichinger, D. (2002). The enteric parasite *Entamoeba* uses an autocrine catecholamine system during differentiation into the infectious cyst stage. *J. Biol. Chem.* **277**, 8083–8090.
- Cruz-Reyes, J., ur-Rehman, T., Spice, W. M., and Ackers, J. P. (1995). A novel transcribed repeat element from *Entamoeba histolytica*. *Gene* **166**, 183–184.
- Cruz-Reyes, J. A., and Ackers, J. P. (1992). A DNA probe specific to pathogenic *Entamoeba histolytica*. *Arch. Med. Res.* **23**, 271–275.
- Das, A. K., Cohen, P. W., and Barford, D. (1998). The structure of the tetratricopeptide repeats of protein phosphatase 5: Implications for TPR-mediated protein–protein interactions. *EMBO J.* **17**, 1192–1199.
- Das, S., and Lohia, A. (2002). Delinking of S phase and cytokinesis in the protozoan parasite *Entamoeba histolytica*. *Cell. Microbiol.* **4**, 55–60.
- Das, S., Stevens, T., Castillo, C., Villasenor, A., Arredondo, H., and Reddy, K. (2002). Lipid metabolism in mucous-dwelling amitochondriate protozoa. *Int. J. Parasitol.* **32**, 655–675.
- Das, S., Van Dellen, K., Bulik, D., Magnelli, P., Cui, J., Head, J., Robbins, P. W., and Samuelson, J. (2006). The cyst wall of *Entamoeba invadens* contains chitosan (deacetylated chitin). *Mol. Biochem. Parasitol.* **148**, 86–92.
- Davis, J. A., Takagi, Y., Kornberg, R. D., and Asturias, F. A. (2002). Structure of the yeast RNA polymerase II holoenzyme: Mediator conformation and polymerase interaction. *Mol. Cell* **10**, 409–415.
- Davis, P. H., Zhang, Z., Chen, M., Zhang, X., Chakraborty, S., and Stanley, S. L., Jr. (2006). Identification of a family of BspA like surface proteins of *Entamoeba histolytica* with novel leucine rich repeats. *Mol. Biochem. Parasitol.* **145**, 111–116.

- Davis, P. H., Schulze, J., and Stanley, S. L., Jr. (2007). Transcriptomic comparison of two *Entamoeba histolytica* strains with defined virulence phenotypes identifies new virulence factor candidates and key differences in the expression patterns of cysteine proteases, lectin light chains, and calmodulin. *Mol. Biochem. Parasitol.* **151**, 118–128.
- de Muñoz, M. L., Moreno, M. A., Pérez-García, J. N., Tovar, G. R., and Hernandez, V. I. (1991). Possible role of calmodulin in the secretion of *Entamoeba histolytica* electron-dense granules containing collagenase. *Mol. Microbiol.* **5**, 1707–1714.
- de la Vega, H., Specht, C. A., Semino, C. E., Robbins, P. W., Eichinger, D., Caplivski, D., Ghosh, S., and Samuelson, J. (1997). Cloning and expression of chitinases of *Entamoebae*. *Mol. Biochem. Parasitol.* **85**, 139–147.
- Dear, P. H., and Cook, P. R. (1993). Happy mapping: Linkage mapping using a physical analogue of meiosis. *Nucl. Acids Res.* **21**, 13–20.
- Debnath, A., Das, P., Sajid, M., and McKerrow, J. H. (2004). Identification of genomic responses to collagen binding by trophozoites of *Entamoeba histolytica*. *J. Infect. Dis.* **190**, 448–457.
- Demarque, M., Represa, A., Becq, H., Khalilov, I., Ben-Ari, Y., and Aniksztejn, L. (2002). Paracrine intercellular communication by a Ca²⁺—and SNARE-independent release of GABA and glutamate prior to synapse formation. *Neuron* **36**, 1051–1061.
- Deng, Z., Huang, M., Singh, K., Albach, R. A., Latshaw, S. P., Chang, K. P., and Kemp, R. G. (1998). Cloning and expression of the gene for the active PPI-dependent phosphofructokinase of *Entamoeba histolytica*. *Biochem. J.* **329**, 659–664.
- Dhar, S. K., Choudhury, N. R., Bhattacharya, A., and Bhattacharya, S. (1995). A multitude of circular DNAs exist in the nucleus of *Entamoeba histolytica*. *Mol. Biochem. Parasitol.* **70**, 203–206.
- Diamond, L. S., and Cunnick, C. C. (1991). A serum-free, partly defined medium, PDM-805, for the axenic cultivation of *Entamoeba histolytica* Schaudinn, 1903 and other *Entamoeba*. *J. Protozool.* **38**, 211–216.
- Dodson, J. M., Clark, C. G., Lockhart, L. A., Leo, B. M., Schroeder, J. W., and Mann, B. J. (1997). Comparison of adherence, cytotoxicity, and Gal/GalNAc lectin gene structure in *Entamoeba histolytica* and *Entamoeba dispar*. *Parasitol. Int.* **46**, 225–235.
- Donaldson, J. G., Cassel, D., Kahn, R. A., and Klausner, R. D. (1992). ADP-ribosylation factor, a small GTP-binding protein, is required for binding of the coatamer protein beta-COP to Golgi membranes. *Proc. Natl. Acad. Sci. USA* **89**, 6408–6412.
- Doolittle, W. F. (1998). You are what you eat: A gene transfer ratchet could account for bacterial genes in eukaryotic nuclear genomes. *Trends Genet.* **14**, 307–311.
- Doolittle, W. F., Boucher, Y., Nesbo, C. L., Douady, C. J., Andersson, J. O., and Roger, A. J. (2003). How big is the iceberg of which organellar genes in nuclear genomes are but the tip? *Phil. Trans. R. Soc. Lond. Ser. B, Biol. Sci.* **358**, 39–57; discussion 57–38.
- Dresios, J., Panopoulos, P., Suzuki, K., and Synetos, D. (2003). A dispensable yeast ribosomal protein optimizes peptidyltransferase activity and affects translocation. *J. Biol. Chem.* **278**, 3314–3322.
- Droux, M., Ruffet, M. L., Douce, R., and Job, D. (1998). Interactions between serine acetyltransferase and O-acetylserine (thiol) lyase in higher plants: Structural and kinetic properties of the free and bound enzymes. *Eur. J. Biochem.* **255**, 235–245.
- Duden, R., Kajikawa, L., Wuestehube, L., and Schekman, R. (1998). epsilon-COP is a structural component of coatamer that functions to stabilize alpha-COP. *EMBO J.* **17**, 985–995.
- Dulubova, I., Sugita, S., Hill, S., Hosaka, M., Fernandez, I., Sudhof, T. C., and Rizo, J. (1999). A conformational switch in syntaxin during exocytosis: Role of munc18. *EMBO J.* **18**, 4372–4382.
- Dutcher, S. K. (2001). The tubulin fraternity: Alpha to eta. *Curr. Opin. Cell Biol.* **13**, 49–54.
- Ehrenkauf, G. M., Haque, R., Hackney, J. A., Eichinger, D. J., and Singh, U. (2007). Identification of developmentally regulated genes in *Entamoeba histolytica*: Insights into mechanisms of stage conversion in a protozoan parasite. *Cell. Microbiol.* **9**, 1426–1444.

- Eichinger, D. (1997). Encystation of *Entamoeba* parasites. *Bioessays* **19**, 633–639.
- Eichinger, D. (2001). Encystation in parasitic protozoa. *Curr. Opin. Microbiol.* **4**, 421–426.
- Eichinger, L., Pachebat, J. A., Glockner, G., Rajandream, M. A., Suggang, R., Berriman, M., Song, J., Olsen, R., Szafranski, K., Xu, Q., Tunggal, B., Kummerfeld, S., *et al.* (2005). The genome of the social amoeba *Dictyostelium discoideum*. *Nature* **435**, 43–57.
- Elnekave, K., Siman-Tov, R., and Ankri, S. (2003). Consumption of L-arginine mediated by *Entamoeba histolytica* L-arginase (EhArg) inhibits amoebicidal activity and nitric oxide production by activated macrophages. *Parasite Immunol.* **25**, 597–608.
- Espenshade, P., Gimeno, R. E., Holzmacher, E., Teung, P., and Kaiser, C. A. (1995). Yeast SEC16 gene encodes a multidomain vesicle coat protein that interacts with Sec23p. *J. Cell Biol.* **131**, 311–324.
- Espinosa-Cantellano, M., and Martínez-Palomo, A. (2000). Pathogenesis of intestinal amebiasis: From molecules to disease. *Clin. Microbiol. Rev.* **13**, 318–331.
- Fahey, R. C., Newton, G. L., Arrick, B., Overdank-Bogart, T., and Aley, S. B. (1984). *Entamoeba histolytica*: A eukaryote without glutathione metabolism. *Science* **224**, 70–72.
- Fairlamb, A. H., and Cerami, A. (1992). Metabolism and functions of trypanothione in the Kinetoplastida. *Annu. Rev. Microbiol.* **46**, 695–729.
- Farri, T. A., Sargeant, P. G., Warhurst, D. C., Williams, J. E., and Bhojani, R. (1980). Electrophoretic studies of the hexokinase of *Entamoeba histolytica* groups I to IV. *Trans. R. Soc. Trop. Med. Hyg.* **74**, 672–673.
- Faundez, V., Horng, J. T., and Kelly, R. B. (1998). A function for the AP3 coat complex in synaptic vesicle formation from endosomes. *Cell* **93**, 423–432.
- Field, J., Rosenthal, B., and Samuelson, J. (2000). Early lateral transfer of genes encoding malic enzyme, acetyl-CoA synthetase and alcohol dehydrogenases from anaerobic prokaryotes to *Entamoeba histolytica*. *Mol. Microbiol.* **38**, 446–455.
- Folsch, H., Ohno, H., Bonifacino, J. S., and Mellman, I. (1999). A novel clathrin adaptor complex mediates basolateral targeting in polarized epithelial cells. *Cell* **99**, 189–198.
- Frederick, J., and Eichinger, D. (2004). *Entamoeba invadens* contains the components of a classical adrenergic signaling system. *Mol. Biochem. Parasitol.* **137**, 339–343.
- Freedman, R. B., Klappa, P., and Ruddock, L. W. (2002). Protein disulfide isomerases exploit synergy between catalytic and specific binding domains. *EMBO Rep.* **3**, 136–140.
- Fridovich, I. (1995). Superoxide radical and superoxide dismutases. *Annu. Rev. Biochem.* **64**, 97–112.
- Frisardi, M., Ghosh, S. K., Field, J., Van Dellen, K., Rogers, R., Robbins, P., and Samuelson, J. (2000). The most abundant glycoprotein of amebic cyst walls (Jacob) is a lectin with five Cys-rich, chitin-binding domains. *Infect. Immun.* **68**, 4217–4224.
- Gadasi, H., and Kessler, E. (1983). Correlation of virulence and collagenolytic activity in *Entamoeba histolytica*. *Infect. Immun.* **39**, 528–531.
- Gangopadhyay, S. S., Ray, S. S., Kennady, K., Pande, G., and Lohia, A. (1997). Heterogeneity of DNA content and expression of cell cycle genes in axenically growing *Entamoeba histolytica* HM1:IMSS clone A. *Mol. Biochem. Parasitol.* **90**, 9–20.
- Gao, T., Furnari, F., and Newton, A. C. (2005). PHLPP: A phosphatase that directly dephosphorylates Akt, promotes apoptosis, and suppresses tumor growth. *Mol. Cell* **18**, 13–24.
- García-Rivera, G., Rodríguez, M. A., Ocadiz, R., Martínez, L. P. M. C., Arroyo, R., González-Robles, A., and Orozco, E. (1999). *Entamoeba histolytica*: A novel cysteine protease and an adhesin form the 112 kDa surface protein. *Mol. Microbiol.* **33**, 556–568.
- Gardner, M. J., Hall, N., Fung, E., White, O., Berriman, M., Hyman, R. W., Carlton, J. M., Pain, A., Nelson, K. E., Bowman, S., Paulsen, I. T., James, K., *et al.* (2002). Genome sequence of the human malaria parasite *Plasmodium falciparum*. *Nature* **419**, 498–511.
- Gelderman, A. H., Bartgis, I. L., Keister, D. B., and Diamond, L. S. (1971a). A comparison of genome sizes and thermal denaturation-derived base composition of DNAs from several members of *Entamoeba* (*histolytica* group). *J. Parasitol.* **57**, 912–916.

- Gelderman, A. H., Keister, D. B., Bartgis, I. L., and Diamond, L. S. (1971b). Characterization of the deoxyribonucleic acid of representative strains of *Entamoeba histolytica*, *E. histolytica*-like amebae, and *E. moshkovskii*. *J. Parasitol.* **57**, 906–911.
- Gemmill, T. R., and Trimble, R. B. (1999). Overview of N- and O-linked oligosaccharide structures found in various yeast species. *Biochim. Biophys. Acta* **1426**, 227–237.
- Gerwig, G. J., van Kuik, J. A., Leeftang, B. R., Kamerling, J. P., Vliegthart, J. F., Karr, C. D., and Jarroll, E. L. (2002). The *Giardia intestinalis* filamentous cyst wall contains a novel beta (1–3)-N-acetyl-D-galactosamine polymer: A structural and conformational study. *Glycobiology* **12**, 499–505.
- Ghosh, S., Frisardi, M., Ramirez-Avila, L., Descoteaux, S., Sturm-Ramirez, K., Newton-Sanchez, O. A., Santos-Preciado, J. I., Ganguly, C., Lohia, A., Reed, S., and Samuelson, J. (2000). Molecular epidemiology of *Entamoeba* spp.: Evidence of a bottleneck (Demographic sweep) and transcontinental spread of diploid parasites. *J. Clin. Microbiol.* **38**, 3815–3821.
- Ghosh, S., Chan, J. M., Lea, C. R., Meints, G. A., Lewis, J. C., Tovian, Z. S., Flessner, R. M., Loftus, T. C., Bruchhaus, I., Kendrick, H., Croft, S. L., Kemp, R. G., *et al.* (2004). Effects of bisphosphonates on the growth of *Entamoeba histolytica* and *Plasmodium* species *in vitro* and *in vivo*. *J. Med. Chem.* **47**, 175–187.
- Gilchrist, C. A., Holm, C. F., Hughes, M. A., Schaenman, J. M., Mann, B. J., and Petri, W. A., Jr. (2001). Identification and characterization of an *Entamoeba histolytica* upstream regulatory element 3 sequence-specific DNA-binding protein containing EF-hand motifs. *J. Biol. Chem.* **276**, 11838–11843.
- Gilchrist, C. A., Houghton, E., Trapaidze, N., Fei, Z., Crasta, O., Asgharpour, A., Evans, C., Martino-Catt, S., Baba, D. J., Stroup, S., Hamano, S., Ehrenkaufer, G., *et al.* (2006). Impact of intestinal colonization and invasion on the *Entamoeba histolytica* transcriptome. *Mol. Biochem. Parasitol.* **147**, 163–176.
- Gillin, F. D., Reiner, D. S., and McCann, P. P. (1984). Inhibition of growth of *Giardia lamblia* by difluoromethylornithine, a specific inhibitor of polyamine biosynthesis. *J. Protozool.* **31**, 161–163.
- Goffeau, A., Barrell, B. G., Bussey, H., Davis, R. W., Dujon, B., Feldmann, H., Galibert, F., Hoheisel, J. D., Jacq, C., Johnston, M., Louis, E. J., Mewes, H. W., *et al.* (1996). Life with 6000 genes. *Science* **274**, 546–567.
- Gomes, C. M., Giuffre, A., Forte, E., Vicente, J. B., Saraiva, L. M., Brunori, M., and Teixeira, M. (2002). A novel type of nitric-oxide reductase. *Escherichia coli* flavorubredoxin. *J. Biol. Chem.* **277**, 25273–25276.
- Gregan, J., Lindner, K., Brimage, L., Franklin, R., Namdar, M., Hart, E. A., Aves, S. J., and Kearsley, S. E. (2003). Fission yeast Cdc23/Mcm10 functions after pre-replicative complex formation to promote Cdc45 chromatin binding. *Mol. Biol. Cell* **14**, 3876–3887.
- Grunler, J., Ericsson, J., and Dallner, G. (1994). Branch-point reactions in the biosynthesis of cholesterol, dolichol, ubiquinone and prenylated proteins. *Biochim. Biophys. Acta* **1212**, 259–277.
- Gu, J., and Gu, X. (2003). Natural history and functional divergence of protein tyrosine kinases. *Gene* **317**, 49–57.
- Guerrant, R. L., Brush, J., Ravdin, J. I., Sullivan, J. A., and Mandell, G. L. (1981). Interaction between *Entamoeba histolytica* and human polymorphonuclear neutrophils. *J. Infect. Dis.* **143**, 83–93.
- Gutsmann, T., Riekens, B., Bruhn, H., Wiese, A., Seydel, U., and Leippe, M. (2003). Interaction of amoebapores and NK-lysin with symmetric phospholipid and asymmetric lipopolysaccharide/phospholipid bilayers. *Biochemistry* **42**, 9804–9812.
- Haghighi, A., Kobayashi, S., Takeuchi, T., Thammapalerd, N., and Nozaki, T. (2003). Geographic diversity among genotypes of *Entamoeba histolytica* field isolates. *J. Clin. Microbiol.* **41**, 3748–3756.

- Hanks, S. K., and Hunter, T. (1995). Protein kinases 6. The eukaryotic protein kinase superfamily: Kinase (catalytic) domain structure and classification. *FASEB J.* **9**, 576–596.
- Hanson, P. I., Roth, R., Morisaki, H., Jahn, R., and Heuser, J. E. (1997). Structure and conformational changes in NSF and its membrane receptor complexes visualized by quick-freeze/deep-etch electron microscopy. *Cell* **90**, 523–535.
- Hara-Kuge, S., Kuge, O., Orci, L., Amherdt, M., Ravazzola, M., Wieland, F. T., and Rothman, J. E. (1994). En bloc incorporation of coatamer subunits during the assembly of COP-coated vesicles. *J. Cell Biol.* **124**, 883–892.
- Hartwell, L. H., and Weinert, T. A. (1989). Checkpoints: Controls that ensure the order of cell cycle events. *Science* **246**, 629–634.
- Hausmann, S., Ho, C. K., Schwer, B., and Shuman, S. (2001). An essential function of *Saccharomyces cerevisiae* RNA triphosphatase Cet1 is to stabilize RNA guanylyltransferase Ceg1 against thermal inactivation. *J. Biol. Chem.* **276**, 36116–36124.
- Hecht, O., Van Nuland, N. A., Schleinkofer, K., Dingley, A. J., Bruhn, H., Leippe, M., and Grotzinger, J. (2004). Solution structure of the pore-forming protein of *Entamoeba histolytica*. *J. Biol. Chem.* **279**, 17834–17841.
- Helenius, A., and Aebi, M. (2004). Roles of N-linked glycans in the endoplasmic reticulum. *Annu. Rev. Biochem.* **73**, 1019–1049.
- Helms, J. B., and Rothman, J. E. (1992). Inhibition by brefeldin A of a Golgi membrane enzyme that catalyses exchange of guanine nucleotide bound to ARF. *Nature* **360**, 352–354.
- Hemming, S. A., and Edwards, A. M. (2000). Yeast RNA polymerase II subunit RPB9. Mapping of domains required for transcription elongation. *J. Biol. Chem.* **275**, 2288–2294.
- Hernandez-Ramirez, V. I., Anaya-Ruiz, M., Rios, A., and Talamas-Rohana, P. (2000). *Entamoeba histolytica*: Tyrosine kinase activity induced by fibronectin through the beta1-integrin-like molecule. *Exp. Parasitol.* **95**, 85–95.
- Hernandez, R., Luna-Arias, J. P., and Orozco, E. (1997). Comparison of the *Entamoeba histolytica* TATA-binding protein (TBP) structure with other TBP. *Arch. Med. Res.* **28** (Spec No), 43–45.
- Hidalgo, M. E., Sanchez, R., Perez, D. G., Rodriguez, M. A., Garcia, J., and Orozco, E. (1997). Molecular characterization of the *Entamoeba histolytica* enolase gene and modelling of the predicted protein. *FEMS Microbiol. Lett.* **148**, 123–129.
- Higgs, H. N., and Peterson, K. J. (2005). Phylogenetic analysis of the formin homology 2 domain. *Mol. Biol. Cell* **16**, 1–13.
- Hirsch, C., Jarosch, E., Sommer, T., and Wolf, D. H. (2004). Endoplasmic reticulum-associated protein degradation: One model fits all? *Biochim. Biophys. Acta* **1695**, 215–223.
- Hirschberg, C. B., Robbins, P. W., and Abeijon, C. (1998). Transporters of nucleotide sugars, ATP, and nucleotide sulfate in the endoplasmic reticulum and Golgi apparatus. *Annu. Rev. Biochem.* **67**, 49–69.
- Hirst, J., Bright, N. A., Rous, B., and Robinson, M. S. (1999). Characterization of a fourth adaptor-related protein complex. *Mol. Biol. Cell* **10**, 2787–2802.
- Hirt, R. P., Harriman, N., Kajava, A. V., and Embley, T. M. (2002). A novel potential surface protein in *Trichomonas vaginalis* contains a leucine-rich repeat shared by micro-organisms from all three domains of life. *Mol. Biochem. Parasitol.* **125**, 195–199.
- Hofmann, B., Hecht, H. J., and Flohe, L. (2002). Peroxiredoxins. *Biol. Chem.* **383**, 347–364.
- Holmgren, A. (2000). Antioxidant function of thioredoxin and glutaredoxin systems. *Antioxid. Redox. Signal.* **2**, 811–820.
- Hooft van Huijsduijnen, R. (1998). Protein tyrosine phosphatases: Counting the trees in the forest. *Gene* **225**, 1–8.
- Horner, D. S., Hirt, R. P., and Embley, T. M. (1999). A single eubacterial origin of eukaryotic pyruvate: Ferredoxin oxidoreductase genes: Implications for the evolution of anaerobic eukaryotes. *Mol. Biol. Evol.* **16**, 1280–1291.

- Hsiung, Y. G., Chang, H. C., Pellequer, J. L., La Valle, R., Lanker, S., and Wittenberg, C. (2001). F-box protein Grr1 interacts with phosphorylated targets via the cationic surface of its leucine-rich repeat. *Mol. Cell. Biol.* **21**, 2506–2520.
- Hubbard, S. C., and Ivatt, R. J. (1981). Synthesis and processing of asparagine-linked oligosaccharides. *Annu. Rev. Biochem.* **50**, 555–583.
- Huber, L. A., Pimplikar, S., Parton, R. G., Virta, H., Zerial, M., and Simons, K. (1993). Rab8, a small GTPase involved in vesicular traffic between the TGN and the basolateral plasma membrane. *J. Cell Biol.* **123**, 35–45.
- Hunter, T. (1995). Protein kinases and phosphatases: The yin and yang of protein phosphorylation and signaling. *Cell* **80**, 225–236.
- Hunter, W. N., Bond, C. S., Gabrielsen, M., and Kemp, L. E. (2003). Structure and reactivity in the non-mevalonate pathway of isoprenoid biosynthesis. *Biochem. Soc. Trans.* **31**, 537–542.
- Ito, M. (2005). Conservation and diversification of three-repeat Myb transcription factors in plants. *J. Plant Res.* **118**, 61–69.
- Iwashita, J., Sato, Y., Kobayashi, S., Takeuchi, T., and Abe, T. (2005). Isolation and functional analysis of a chk2 homologue from *Entamoeba histolytica*. *Parasitol. Int.* **54**, 21–27.
- Jacobs, T., Bruchhaus, I., Dandekar, T., Tannich, E., and Leippe, M. (1998). Isolation and molecular characterization of a surface-bound proteinase of *Entamoeba histolytica*. *Mol. Microbiol.* **27**, 269–276.
- Jain, R., Rivera, M. C., and Lake, J. A. (1999). Horizontal gene transfer among genomes: The complexity hypothesis. *Proc. Natl. Acad. Sci. USA* **96**, 3801–3806.
- Jeffrey, P. D., Russo, A. A., Polyak, K., Gibbs, E., Hurwitz, J., Massague, J., and Pavletich, N. P. (1995). Mechanism of CDK activation revealed by the structure of a cyclinA-CDK2 complex. *Nature* **376**, 313–320.
- Jongsareejit, B., Rahman, R. N., Fujiwara, S., and Imanaka, T. (1997). Gene cloning, sequencing and enzymatic properties of glutamate synthase from the hyperthermophilic archaeon *Pyrococcus* sp. KOD1. *Mol. Gen. Genet.* **254**, 635–642.
- Jordan, I. K., Henze, K., Fedorova, N. D., Koonin, E. V., and Galperin, M. Y. (2003). Phylogenomic analysis of the *Giardia intestinalis* transcarboxylase reveals multiple instances of domain fusion and fission in the evolution of biotin-dependent enzymes. *J. Mol. Microbiol. Biotechnol.* **5**, 172–189.
- Juarez, P., Sanchez-Lopez, R., Stock, R. P., Olvera, A., Ramos, M. A., and Alagon, A. (2001). Characterization of the Ehrab8 gene, a marker of the late stages of the secretory pathway of *Entamoeba histolytica*. *Mol. Biochem. Parasitol.* **116**, 223–228.
- Jurica, M. S., and Moore, M. J. (2003). Pre-mRNA splicing: Awash in a sea of proteins. *Mol. Cell* **12**, 5–14.
- Kafetzopoulos, D., Thireos, G., Vournakis, J. N., and Bouriotis, V. (1993). The primary structure of a fungal chitin deacetylase reveals the function for two bacterial gene products. *Proc. Natl. Acad. Sci. USA* **90**, 8005–8008.
- Kahn, R. A., and Gilman, A. G. (1984). Purification of a protein cofactor required for ADP-ribosylation of the stimulatory regulatory component of adenylate cyclase by cholera toxin. *J. Biol. Chem.* **259**, 6228–6234.
- Kahn, R. A., Cherfils, J., Elias, M., Lovering, R. C., Munro, S., and Schurmann, A. (2006). Nomenclature for the human Arf family of GTP-binding proteins: ARF, ARL, and SAR proteins. *J. Cell Biol.* **172**, 645–650.
- Kaiser, C. (2000). Thinking about p24 proteins and how transport vesicles select their cargo. *Proc. Natl. Acad. Sci. USA* **97**, 3783–3785.
- Kang, J. S., Kim, S. H., Hwang, M. S., Han, S. J., Lee, Y. C., and Kim, Y. J. (2001). The structural and functional organization of the yeast mediator complex. *J. Biol. Chem.* **276**, 42003–42010.
- Katinka, M. D., Duprat, S., Cornillot, E., Metenier, G., Thomarat, F., Prensier, G., Barbe, V., Peyretailade, E., Brottier, P., Wincker, P., Delbac, F., El Alaoui, H., *et al.* (2001). Genome sequence and gene compaction of the eukaryote parasite *Encephalitozoon cuniculi*. *Nature* **414**, 450–453.

- Keen, J. H. (1987). Clathrin assembly proteins: Affinity purification and a model for coat assembly. *J. Cell Biol.* **105**, 1989–1998.
- Keene, W. E., Hidalgo, M. E., Orozco, E., and McKerrow, J. H. (1990). *Entamoeba histolytica*: Correlation of the cytopathic effect of virulent trophozoites with secretion of a cysteine proteinase. *Exp. Parasitol.* **71**, 199–206.
- Kelleher, D. J., and Gilmore, R. (2006). An evolving view of the eukaryotic oligosaccharyl-transferase. *Glycobiology* **16**, 47R–62R.
- Kelman, L. M., and Kelman, Z. (2004). Multiple origins of replication in archaea. *Trends Microbiol.* **12**, 399–401.
- Kennelly, P. J. (2001). Protein phosphatases: A phylogenetic perspective. *Chem. Rev.* **101**, 2291–2312.
- Kimura, A., Hara, Y., Kimoto, T., Okuno, Y., Minekawa, Y., and Nakabayashi, T. (1996). Cloning and expression of a putative alcohol dehydrogenase gene of *Entamoeba histolytica* and its application to immunological examination. *Clin. Diagn. Lab. Immunol.* **3**, 270–274.
- Kirchhausen, T. (2000). Three ways to make a vesicle. *Nat. Rev. Mol. Cell Biol.* **1**, 187–198.
- Kirisako, T., Ichimura, Y., Okada, H., Kabeya, Y., Mizushima, N., Yoshimori, T., Ohsumi, M., Takao, T., Noda, T., and Ohsumi, Y. (2000). The reversible modification regulates the membrane-binding state of Apg8/Aut7 essential for autophagy and the cytoplasm to vacuole targeting pathway. *J. Cell Biol.* **151**, 263–276.
- Knodler, L. A., Edwards, M. R., and Schofield, P. J. (1994). The intracellular amino acid pools of *Giardia intestinalis*, *Trichomonas vaginalis*, and *Crithidia luciliae*. *Exp. Parasitol.* **79**, 117–125.
- Kobe, B., and Deisenhofer, J. (1994). The leucine-rich repeat: A versatile binding motif. *Trends Biochem. Sci.* **19**, 415–421.
- Koonin, E. V., Makarova, K. S., and Aravind, L. (2001). Horizontal gene transfer in prokaryotes: Quantification and classification. *Annu. Rev. Microbiol.* **55**, 709–742.
- Kornberg, R. D. (2001). The eukaryotic gene transcription machinery. *Biol. Chem.* **382**, 1103–1107.
- Kornfeld, R., and Kornfeld, S. (1985). Assembly of asparagine-linked oligosaccharides. *Annu. Rev. Biochem.* **54**, 631–664.
- Kriebel, P. W., and Parent, C. A. (2004). Adenylyl cyclase expression and regulation during the differentiation of *Dictyostelium discoideum*. *IUBMB Life* **56**, 541–546.
- Kroschewski, H., Ortner, S., Steipe, B., Scheiner, O., Wiedermann, G., and Duchêne, M. (2000). Differences in substrate specificity and kinetic properties of the recombinant hexokinases HXK1 and HXK2 from *Entamoeba histolytica*. *Mol. Biochem. Parasitol.* **105**, 71–80.
- Kulda, J. (1999). Trichomonads, hydrogenosomes and drug resistance. *Int. J. Parasitol.* **29**, 199–212.
- Kumagai, M., Makioka, A., Takeuchi, T., and Nozaki, T. (2004). Molecular cloning and characterization of a protein farnesyltransferase from the enteric protozoan parasite *Entamoeba histolytica*. *J. Biol. Chem.* **279**, 2316–2323.
- Kumar, A., Shen, P. S., Descoteaux, S., Pohl, J., Bailey, G., and Samuelson, J. (1992). Cloning and expression of an NADP⁺-dependent alcohol dehydrogenase gene of *Entamoeba histolytica*. *Proc. Natl. Acad. Sci. USA* **89**, 10188–10192.
- Kupke, T., Uebele, M., Schmid, D., Jung, G., Blaesle, M., and Steinbacher, S. (2000). Molecular characterization of lantibiotic-synthesizing enzyme EpiD reveals a function for bacterial Dfp proteins in coenzyme A biosynthesis. *J. Biol. Chem.* **275**, 31838–31846.
- Kupke, T. (2002). Molecular characterization of the 4'-phosphopantothienoylcysteine synthetase domain of bacterial dfp flavoproteins. *J. Biol. Chem.* **277**, 36137–36145.
- Kupke, T. (2004). Active-site residues and amino acid specificity of the bacterial 4'-phosphopantothienoylcysteine synthetase CoaB. *Eur. J. Biochem.* **271**, 163–172.
- Kuranda, M. J., and Robbins, P. W. (1991). Chitinase is required for cell separation during growth of *Saccharomyces cerevisiae*. *J. Biol. Chem.* **266**, 19758–19767.

- Lal, K., Field, M. C., Carlton, J. M., Warwicker, J., and Hirt, R. P. (2005). Identification of a very large Rab GTPase family in the parasitic protozoan *Trichomonas vaginalis*. *Mol. Biochem. Parasitol.* **143**, 226–235.
- Landa, A., Rojo-Dominguez, A., Jimenez, L., and Fernandez-Velasco, D. A. (1997). Sequencing, expression and properties of triosephosphate isomerase from *Entamoeba histolytica*. *Eur. J. Biochem.* **247**, 348–355.
- Lander, E. S., Linton, L. M., Birren, B., Nusbaum, C., Zody, M. C., Baldwin, J., Devon, K., Dewar, K., Doyle, M., FitzHugh, W., Funke, R., Gage, D., *et al.* (2001). Initial sequencing and analysis of the human genome. *Nature* **409**, 860–921.
- Lawrence, J. G. (2005a). Horizontal and vertical gene transfer: The life history of pathogens. *Contrib. Microbiol.* **12**, 255–271.
- Lawrence, J. G. (2005b). Common themes in the genome strategies of pathogens. *Curr. Opin. Genet. Dev.* **15**, 584–588.
- Le Borgne, R., Planque, N., Martin, P., Dewitte, F., Saule, S., and Hoflack, B. (2001). The AP-3-dependent targeting of the melanosomal glycoprotein QNR-71 requires a di-leucine-based sorting signal. *J. Cell Sci.* **114**, 2831–2841.
- Lee, F. J., Huang, C. F., Yu, W. L., Buu, L. M., Lin, C. Y., Huang, M. C., Moss, J., and Vaughan, M. (1997a). Characterization of an ADP-ribosylation factor-like 1 protein in *Saccharomyces cerevisiae*. *J. Biol. Chem.* **272**, 30998–31005.
- Lee, J. H., Kim, J. M., Kim, M. S., Lee, Y. T., Marshak, D. R., and Bae, Y. S. (1997b). The highly basic ribosomal protein L41 interacts with the beta subunit of protein kinase CKII and stimulates phosphorylation of DNA topoisomerase IIalpha by CKII. *Biochem. Biophys. Res. Commun.* **238**, 462–467.
- Leippe, M., Ebel, S., Schoenberger, O. L., Horstmann, R. D., and Müller-Eberhard, H. J. (1991). Pore-forming peptide of pathogenic *Entamoeba histolytica*. *Proc. Natl. Acad. Sci. USA* **88**, 7659–7663.
- Leippe, M., Tannich, E., Nickel, R., van der Goot, G., Pattus, F., Horstmann, R. D., and Müller-Eberhard, H. J. (1992). Primary and secondary structure of the pore-forming peptide of pathogenic *Entamoeba histolytica*. *EMBO J.* **11**, 3501–3506.
- Leippe, M., Andrä, J., and Müller-Eberhard, H. J. (1994a). Cytolytic and antibacterial activity of synthetic peptides derived from amoebapore, the pore-forming peptide of *Entamoeba histolytica*. *Proc. Natl. Acad. Sci. USA* **91**, 2602–2606.
- Leippe, M., Andrä, J., Nickel, R., Tannich, E., and Müller-Eberhard, H. J. (1994b). Amoebapores, a family of membranolytic peptides from cytoplasmic granules of *Entamoeba histolytica*: Isolation, primary structure, and pore formation in bacterial cytoplasmic membranes. *Mol. Microbiol.* **14**, 895–904.
- Leippe, M., Sievertsen, H. J., Tannich, E., and Horstmann, R. D. (1995). Spontaneous release of cysteine proteinases but not of pore-forming peptides by viable *Entamoeba histolytica*. *Parasitology* **111**, 569–574.
- Leippe, M. (1997). Amoebapores. *Parasitol. Today* **13**, 178–183.
- Leippe, M. (1999). Antimicrobial and cytolytic polypeptides of amoeboid protozoa: Effector molecules of primitive phagocytes. *Dev. Comp. Immunol.* **23**, 267–279.
- Leippe, M., Bruhn, H., Hecht, O., and Grotzinger, J. (2005). Ancient weapons: The three-dimensional structure of amoebapore A. *Trends Parasitol.* **21**, 5–7.
- Leon-Avila, G., and Tovar, J. (2004). Mitosomes of *Entamoeba histolytica* are abundant mitochondrion-related remnant organelles that lack a detectable organellar genome. *Microbiology* **150**, 1245–1250.
- Leung, C. L., Green, K. J., and Liem, R. K. (2002). Plakins: A family of versatile cytolinker proteins. *Trends Cell Biol.* **12**, 37–45.
- Li, E., Yang, W. G., Zhang, T., and Stanley, S. L., Jr. (1995). Interaction of laminin with *Entamoeba histolytica* cysteine proteinases and its effect on amebic pathogenesis. *Infect. Immun.* **63**, 4150–4153.

- Li, L., and Dixon, J. E. (2000). Form, function, and regulation of protein tyrosine phosphatases and their involvement in human diseases. *Semin. Immunol.* **12**, 75–84.
- Li, Y., Chen, Z. Y., Wang, W., Baker, C. C., and Krug, R. M. (2001). The 3'-end-processing factor CPSF is required for the splicing of single-intron pre-mRNAs *in vivo*. *RNA* **7**, 920–931.
- Liepinsh, E., Andersson, M., Ruyschaert, J. M., and Otting, G. (1997). Saposin fold revealed by the NMR structure of NK-lysin. *Nat. Struct. Biol.* **4**, 793–795.
- Linstead, D., and Cranshaw, M. A. (1983). The pathway of arginine catabolism in the parasitic flagellate *Trichomonas vaginalis*. *Mol. Biochem. Parasitol.* **8**, 241–252.
- Lioutas, C., Schmetz, C., and Tannich, E. (1995). Identification of various circular DNA molecules in *Entamoeba histolytica*. *Exp. Parasitol.* **80**, 349–352.
- Lioutas, C., and Tannich, E. (1995). Transcription of protein-coding genes in *Entamoeba histolytica* is insensitive to high concentrations of α -amanitin. *Mol. Biochem. Parasitol.* **73**, 259–261.
- Lo, H., and Reeves, R. E. (1980). Purification and properties of NADPH:flavin oxidoreductase from *Entamoeba histolytica*. *Mol. Biochem. Parasitol.* **2**, 23–30.
- Lo, H. S., and Reeves, R. E. (1978). Pyruvate-to-ethanol pathway in *Entamoeba histolytica*. *Biochem. J.* **171**, 225–230.
- Lobelle-Rich, P. A., and Reeves, R. E. (1983). Separation and characterization of two UTP-utilizing hexose phosphate uridylyltransferases from *Entamoeba histolytica*. *Mol. Biochem. Parasitol.* **7**, 173–182.
- Lockwood, B. C., and Coombs, G. H. (1991). Purification and characterization of methionine gamma-lyase from *Trichomonas vaginalis*. *Biochem. J.* **279**, 675–682.
- Loftus, B., Anderson, I., Davies, R., Alsmark, U. C., Samuelson, J., Amedeo, P., Roncaglia, P., Berriman, M., Hirt, R. P., Mann, B. J., Nozaki, T., Suh, B., *et al.* (2005). The genome of the protist parasite *Entamoeba histolytica*. *Nature* **433**, 865–868.
- Loftus, B. J., and Hall, N. (2005). *Entamoeba*: Still more to be learned from the genome. *Trends Parasitol.* **21**, 453.
- Lohia, A., and Samuelson, J. (1993). Cloning of the *Eh cdc2* gene from *Entamoeba histolytica* encoding a protein kinase p34^{cdc2} homologue. *Gene* **127**, 203–207.
- Lohia, A., Hait, N. C., and Lahiri Majumder, A. (1999). L-myo-inositol 1-phosphate synthase from *Entamoeba histolytica*. *Mol. Biochem. Parasitol.* **98**, 67–79.
- Long-Krug, S. A., Fischer, K. J., Hysmith, R. M., and Ravdin, J. I. (1985). Phospholipase A enzymes of *Entamoeba histolytica*: Description and subcellular localization. *J. Infect. Dis.* **152**, 536–541.
- Lu, L., Horstmann, H., Ng, C., and Hong, W. (2001). Regulation of Golgi structure and function by ARF-like protein 1 (Arl1). *J. Cell Sci.* **114**, 4543–4555.
- Lu, L., Tai, G., and Hong, W. (2004). Autoantigen Golgin-97, an effector of Arl1 GTPase, participates in traffic from the endosome to the trans-golgi network. *Mol. Biol. Cell* **15**, 4426–4443.
- Luaces, A. L., and Barrett, A. J. (1988). Affinity purification and biochemical characterization of histolysin, the major cysteine proteinase of *Entamoeba histolytica*. *Biochem. J.* **250**, 903–909.
- Luaces, A. L., Pico, T., and Barrett, A. J. (1992). The ENZYMEBA test: Detection of intestinal *Entamoeba histolytica* infection by immuno-enzymatic detection of histolysin. *Parasitology* **105**, 203–205.
- Lushbaugh, W. B., Hofbauer, A. F., and Pittman, F. E. (1984). Proteinase activities of *Entamoeba histolytica* cytotoxin. *Gastroenterology* **87**, 17–27.
- Lushbaugh, W. B., Hofbauer, A. F., and Pittman, F. E. (1985). *Entamoeba histolytica*: Purification of cathepsin B. *Exp. Parasitol.* **59**, 328–336.
- MacFarlane, R. C., and Singh, U. (2006). Identification of differentially expressed genes in virulent and nonvirulent *Entamoeba* species: Potential implications for amebic pathogenesis. *Infect. Immun.* **74**, 340–351.

- Machida, Y. J., Hamlin, J. L., and Dutta, A. (2005). Right place, right time, and only once: Replication initiation in metazoans. *Cell* **123**, 13–24.
- MacKevlie, S. H., Andrews, P. D., and Stark, M. J. (1995). The *Saccharomyces cerevisiae* gene SDS22 encodes a potential regulator of the mitotic function of yeast type 1 protein phosphatase. *Mol. Cell. Biol.* **15**, 3777–3785.
- Mai, Z., Ghosh, S., Frisardi, M., Rosenthal, B., Rogers, R., and Samuelson, J. (1999). Hsp60 is targeted to a cryptic mitochondrion-derived organelle ("Crypton") in the microaerophilic protozoan parasite *Entamoeba histolytica*. *Mol. Cell. Biol.* **19**, 2198–2205.
- Maiorano, D., Lutzmann, M., and Mechali, M. (2006). MCM proteins and DNA replication. *Curr. Opin. Cell Biol.* **18**, 130–136.
- Majoros, W. H., Pertea, M., and Salzberg, S. L. (2004). TigrScan and GlimmerHMM: Two open source ab initio eukaryotic gene-finders. *Bioinformatics* **20**, 2878–2879.
- Makioka, A., Kumagai, M., Takeuchi, T., and Nozaki, T. (2006). Characterization of protein geranylgeranyltransferase I from the enteric protist *Entamoeba histolytica*. *Mol. Biochem. Parasitol.* **145**, 216–225.
- Mallet, L., Renault, G., and Jacquet, M. (2000). Functional cloning of the adenylate cyclase gene of *Candida albicans* in *Saccharomyces cerevisiae* within a genomic fragment containing five other genes, including homologues of CHS6 and SAP185. *Yeast* **16**, 959–966.
- Mallik, R., and Gross, S. P. (2004). Molecular motors: Strategies to get along. *Curr. Biol.* **14**, R971–R982.
- Mandal, P. K., Bagchi, A., Bhattacharya, A., and Bhattacharya, S. (2004). An *Entamoeba histolytica* LINE/SINE pair inserts at common target sites cleaved by the restriction enzyme-like LINE-encoded endonuclease. *Eukaryot. Cell* **3**, 170–179.
- Mann, B. J., Torian, B. E., Vedvick, T. S., and Petri, W. A., Jr. (1991). Sequence of a cysteine-rich galactose-specific lectin of *Entamoeba histolytica*. *Proc. Natl. Acad. Sci. USA* **88**, 3248–3252.
- Marino, G., Uria, J. A., Puente, X. S., Quesada, V., Bordallo, J., and Lopez-Otin, C. (2003). Human autophagins, a family of cysteine proteinases potentially implicated in cell degradation by autophagy. *J. Biol. Chem.* **278**, 3671–3678.
- Marion, S., Wilhelm, C., Voigt, H., Bacri, J. C., and Guillen, N. (2004). Overexpression of myosin IB in living *Entamoeba histolytica* enhances cytoplasm viscosity and reduces phagocytosis. *J. Cell Sci.* **117**, 3271–3279.
- Marion, S., Laurent, C., and Guillen, N. (2005). Signalization and cytoskeleton activity through myosin IB during the early steps of phagocytosis in *Entamoeba histolytica*: A proteomic approach. *Cell. Microbiol.* **7**, 1504–1518.
- Marsh, J. J., and Lebherz, H. G. (1992). Fructose-bisphosphate aldolases: An evolutionary history. *Trends Biochem. Sci.* **17**, 110–113.
- Martin, W., and Müller, M. (1998). The hydrogen hypothesis for the first eukaryote. *Nature* **392**, 37–41.
- Masai, H., and Arai, K. (2002). Cdc7 kinase complex: A key regulator in the initiation of DNA replication. *J. Cell. Physiol.* **190**, 287–296.
- Massague, J., Blain, S. W., and Lo, R. S. (2000). TGFbeta signaling in growth control, cancer, and heritable disorders. *Cell* **103**, 295–309.
- Maurer-Stroh, S., Washietl, S., and Eisenhaber, F. (2003). Protein prenyltransferases: Anchor size, pseudogenes and parasites. *Biol. Chem.* **384**, 977–989.
- Mayer, A., Wickner, W., and Haas, A. (1996). Sec18p (NSF)-driven release of Sec17p (alpha-SNAP) can precede docking and fusion of yeast vacuoles. *Cell* **85**, 83–94.
- Mazzuco, A., Benchimol, M., and De Souza, W. (1997). Endoplasmic reticulum and Golgi-like elements in *Entamoeba*. *Micron* **28**, 241–247.
- McCarty, D. R., and Chory, J. (2000). Conservation and innovation in plant signaling pathways. *Cell* **103**, 201–209.

- McCoy, J. J., Mann, B. J., Vedvick, T. S., Pak, Y., Heimark, D. B., and Petri, W. A., Jr. (1993). Structural analysis of the light subunit of the *Entamoeba histolytica* galactose-specific adherence lectin. *J. Biol. Chem.* **268**, 24223–24231.
- McLaughlin, J., and Faubert, G. (1977). Partial purification and some properties of a neutral sulfhydryl and an acid proteinase from *Entamoeba histolytica*. *Can. J. Microbiol.* **23**, 420–425.
- McTaggart, S. J. (2006). Isoprenylated proteins. *Cell. Mol. Life Sci.* **63**, 255–267.
- Mehlotra, R. K. (1996). Antioxidant defense mechanisms in parasitic protozoa. *Crit. Rev. Microbiol.* **22**, 295–314.
- Memon, A. R. (2004). The role of ADP-ribosylation factor and SAR1 in vesicular trafficking in plants. *Biochim. Biophys. Acta* **1664**, 9–30.
- Merchant, A. M., Kawasaki, Y., Chen, Y., Lei, M., and Tye, B. K. (1997). A lesion in the DNA replication initiation factor Mcm10 induces pausing of elongation forks through chromosomal replication origins in *Saccharomyces cerevisiae*. *Mol. Cell. Biol.* **17**, 3261–3271.
- Meyer, C., Zizioli, D., Lausmann, S., Eskelinen, E. L., Hamann, J., Saftig, P., von Figura, K., and Schu, P. (2000). mu1A-adaptin-deficient mice: Lethality, loss of AP-1 binding and rerouting of mannose 6-phosphate receptors. *EMBO J.* **19**, 2193–2203.
- Meza, I., Sabanero, M., Cázares, F., and Bryan, J. (1983). Isolation and characterization of actin from *Entamoeba histolytica*. *J. Biol. Chem.* **258**, 3936–3941.
- Mira, A., Pushker, R., Legault, B. A., Moreira, D., and Rodriguez-Valera, F. (2004). Evolutionary relationships of *Fusobacterium nucleatum* based on phylogenetic analysis and comparative genomics. *BMC Evol. Biol.* **4**, 50.
- Mishra, C., Semino, C. E., McCreath, K. J., de la Vega, H., Jones, B. J., Specht, C. A., and Robbins, P. W. (1997). Cloning and expression of two chitin deacetylase genes of *Saccharomyces cerevisiae*. *Yeast* **13**, 327–336.
- Moody-Haupt, S., Patterson, J. H., Mirelman, D., and McConville, M. J. (2000). The major surface antigens of *Entamoeba histolytica* trophozoites are GPI-anchored proteophosphoglycans. *J. Mol. Biol.* **297**, 409–420.
- Morgan, D. O. (1995). Principles of CDK regulation. *Nature* **374**, 131–134.
- Morgan, D. O. (1996). The dynamics of cyclin dependent kinase structure. *Curr. Opin. Cell Biol.* **8**, 767–772.
- Motley, A., Bright, N. A., Seaman, M. N., and Robinson, M. S. (2003). Clathrin-mediated endocytosis in AP-2-depleted cells. *J. Cell Biol.* **162**, 909–918.
- Müller, M. (1986). Reductive activation of nitroimidazoles in anaerobic microorganisms. *Biochem. Pharmacol.* **35**, 37–41.
- Mullikin, J. C., and Ning, Z. (2003). The phusion assembler. *Genome Res.* **13**, 81–90.
- Munford, R. S., Sheppard, P. O., and O'Hara, P. J. (1995). Saposin-like proteins (SAPLIP) carry out diverse functions on a common backbone structure. *J. Lipid Res.* **36**, 1653–1663.
- Munro, S. (2004). Organelle identity and the organization of membrane traffic. *Nat. Cell Biol.* **6**, 469–472.
- Myers, E. W., Sutton, G. G., Delcher, A. L., Dew, I. M., Fasulo, D. P., Flanigan, M. J., Kravitz, S. A., Mobarry, C. M., Reinert, K. H., Remington, K. A., Anson, E. L., Bolanos, R. A., et al. (2000). A whole-genome assembly of *Drosophila*. *Science* **287**, 2196–2204.
- Nakada-Tsukui, K., Saito-Nakano, Y., Ali, V., and Nozaki, T. (2005). A retromerlike complex is a novel Rab7 effector that is involved in the transport of the virulence factor cysteine protease in the enteric protozoan parasite *Entamoeba histolytica*. *Mol. Biol. Cell* **16**, 5294–5303.
- Nakamura, H. (2005). Thioredoxin and its related molecules: Update 2005. *Antioxid. Redox Signal.* **7**, 823–828.
- Nakamura, M., Yamada, M., Hirota, Y., Sugimoto, K., Oka, A., and Takanami, M. (1981). Nucleotide sequence of the asnA gene coding for asparagine synthetase of *E. coli* K-12. *Nucleic Acids Res.* **9**, 4669–4676.
- Nakatsu, F., and Ohno, H. (2003). Adaptor protein complexes as the key regulators of protein sorting in the post-Golgi network. *Cell Struct. Funct.* **28**, 419–429.

- Nebreda, A. R. (2006). CDK activation by non-cyclin proteins. *Curr. Opin. Cell Biol.* **18**, 192–198.
- Nesbo, C. L., L'Haridon, S., Stetter, K. O., and Doolittle, W. F. (2001). Phylogenetic analyses of two "archaeal" genes in *thermotoga maritima* reveal multiple transfers between archaea and bacteria. *Mol. Biol. Evol.* **18**, 362–375.
- Nickel, R., Jacobs, T., Urban, B., Scholze, H., Bruhn, H., and Leippe, M. (2000). Two novel calcium-binding proteins from cytoplasmic granules of the protozoan parasite *Entamoeba histolytica*. *FEBS Lett.* **486**, 112–116.
- Nixon, J. E. J., Wang, A., Field, J., Morrison, H. G., McArthur, A. G., Sogin, M. L., Loftus, B. J., and Samuelson, J. (2002). Evidence for lateral transfer of genes encoding ferredoxins, nitroreductases, NADH oxidase, and alcohol dehydrogenase 3 from anaerobic prokaryotes to *Giardia lamblia* and *Entamoeba histolytica*. *Eukaryot. Cell* **1**, 181–190.
- Novick, P., and Zerial, M. (1997). The diversity of Rab proteins in vesicle transport. *Curr. Opin. Cell Biol.* **9**, 496–504.
- Nozaki, T., Arase, T., Shigeta, Y., Asai, T., Leustek, T., and Takeuchi, T. (1998a). Cloning and bacterial expression of adenosine-5'-triphosphate sulfurylase from the enteric protozoan parasite *Entamoeba histolytica*. *Biochim. Biophys. Acta* **1429**, 284–291.
- Nozaki, T., Asai, T., Kobayashi, S., Ikegami, F., Noji, M., Saito, K., and Takeuchi, T. (1998b). Molecular cloning and characterization of the genes encoding two isoforms of cysteine synthase in the enteric protozoan parasite *Entamoeba histolytica*. *Mol. Biochem. Parasitol.* **97**, 33–44.
- Nozaki, T., Asai, T., Sanchez, L. B., Kobayashi, S., Nakazawa, M., and Takeuchi, T. (1999). Characterization of the gene encoding serine acetyltransferase, a regulated enzyme of cysteine biosynthesis from the protist parasites *Entamoeba histolytica* and *Entamoeba dispar*. Regulation and possible function of the cysteine biosynthetic pathway in *Entamoeba*. *J. Biol. Chem.* **274**, 32445–32452.
- Nozaki, T., Ali, V., and Tokoro, M. (2005). Sulfur-containing amino acid metabolism in parasitic protozoa. *Adv. Parasitol.* **60**, 1–99.
- Ochman, H., Lawrence, J. G., and Groisman, E. A. (2000). Lateral gene transfer and the nature of bacterial innovation. *Nature* **405**, 299–304.
- Okada, M., Huston, C. D., Mann, B. J., Petri, W. A., Jr., Kita, K., and Nozaki, T. (2005). Proteomic analysis of phagocytosis in the enteric protozoan parasite *Entamoeba histolytica*. *Eukaryot. Cell* **4**, 827–831.
- Ondarza, R. N., Tamayo, E. M., Hurtado, G., Hernandez, E., and Iturbe, A. (1997). Isolation and purification of glutathionyl-spermidine and trypanothione from *Entamoeba histolytica*. *Arch. Med. Res.* **28**, 73–75.
- Ondarza, R. N., Hurtado, G., Iturbe, A., Hernandez, E., Tamayo, E., and Woolery, M. (2005). Identification of trypanothione from the human pathogen *Entamoeba histolytica* by mass spectrometry and chemical analysis. *Biotechnol. Appl. Biochem.* **42**, 175–181.
- Ooi, C. E., Dell'Angelica, E. C., and Bonifacino, J. S. (1998). ADP-Ribosylation factor 1 (ARF1) regulates recruitment of the AP-3 adaptor complex to membranes. *J. Cell Biol.* **142**, 391–402.
- Oppendoes, F. R., and Michels, P. A. (2001). Enzymes of carbohydrate metabolism as potential drug targets. *Int. J. Parasitol.* **31**, 482–490.
- Ortner, S., Plaimauer, B., Binder, M., Scheiner, O., Wiedermann, G., and Duchêne, M. (1995). Molecular analysis of two hexokinase isoenzymes from *Entamoeba histolytica*. *Mol. Biochem. Parasitol.* **73**, 189–198.
- Ortner, S., Binder, M., Scheiner, O., Wiedermann, G., and Duchêne, M. (1997a). Molecular and biochemical characterization of phosphoglucomutases from *Entamoeba histolytica* and *Entamoeba dispar*. *Mol. Biochem. Parasitol.* **90**, 121–129.
- Ortner, S., Clark, C. G., Binder, M., Scheiner, O., Wiedermann, G., and Duchêne, M. (1997b). Molecular biology of the hexokinase isoenzyme pattern that distinguishes pathogenic *Entamoeba histolytica* from nonpathogenic *Entamoeba dispar*. *Mol. Biochem. Parasitol.* **86**, 85–94.

- Ostoa-Saloma, P., Carrero, J. C., Petrossian, P., Herion, P., Landa, A., and Laclette, J. P. (2000). Cloning, characterization and functional expression of a cyclophilin of *Entamoeba histolytica*. *Mol. Biochem. Parasitol.* **107**, 219–225.
- Otomo, T., Tomchick, D. R., Otomo, C., Panchal, S. C., Machius, M., and Rosen, M. K. (2005). Structural basis of actin filament nucleation and processive capping by a formin homology 2 domain. *Nature* **433**, 488–494.
- Parsons, M. (2004). Glycosomes: Parasites and the divergence of peroxisomal purpose. *Mol. Microbiol.* **53**, 717–724.
- Pasqualato, S., Renault, L., and Cherfils, J. (2002). Arf, Arl, Arp and Sar proteins: A family of GTP-binding proteins with a structural device for 'front-back' communication. *EMBO Rep.* **3**, 1035–1041.
- Patil, C., and Walter, P. (2001). Intracellular signaling from the endoplasmic reticulum to the nucleus: The unfolded protein response in yeast and mammals. *Curr. Opin. Cell Biol.* **13**, 349–355.
- Peng, R., De Antoni, A., and Gallwitz, D. (2000). Evidence for overlapping and distinct functions in protein transport of coat protein Sec24p family members. *J. Biol. Chem.* **275**, 11521–11528.
- Pereira-Leal, J. B., and Seabra, M. C. (2001). Evolution of the Rab family of small GTP-binding proteins. *J. Mol. Biol.* **313**, 889–901.
- Petoukhov, M. V., Svergun, D. I., Konarev, P. V., Ravasio, S., van den Heuvel, R. H., Curti, B., and Vanoni, M. A. (2003). Quaternary structure of *Azospirillum brasilense* NADPH-dependent glutamate synthase in solution as revealed by synchrotron radiation x-ray scattering. *J. Biol. Chem.* **278**, 29933–29939.
- Petri, W. A., Haque, R., and Mann, B. J. (2002). The bittersweet interface of parasite and host: Lectin-carbohydrate interactions during human invasion by the parasite *Entamoeba histolytica*. *Annu. Rev. Microbiol.* **56**, 39–64.
- Petri, W. A., Jr., Smith, R. D., Schlesinger, P. H., Murphy, C. F., and Ravdin, J. I. (1987). Isolation of the galactose-binding lectin that mediates the in vitro adherence of *Entamoeba histolytica*. *J. Clin. Invest.* **80**, 1238–1244.
- Petri, W. A., Jr., Chapman, M. D., Snodgrass, T., Mann, B. J., Broman, J., and Ravdin, J. I. (1989). Subunit structure of the galactose and *N*-acetyl-D-galactosamine-inhibitable adherence lectin of *Entamoeba histolytica*. *J. Biol. Chem.* **264**, 3007–3012.
- Petri, W. A. J. (2002). Pathogenesis of amebiasis. *Curr. Opin. Microbiol.* **5**, 443–447.
- Pillai, D. R., Britten, D., Ackers, J. P., Ravdin, J. I., and Kain, K. C. (1997). A gene homologous to *hgl2* of *Entamoeba histolytica* is present and expressed in *Entamoeba dispar*. *Mol. Biochem. Parasitol.* **87**, 101–105.
- Pillutla, R. C., Yue, Z., Maldonado, E., and Shatkin, A. J. (1998). Recombinant human mRNA cap methyltransferase binds capping enzyme/RNA polymerase II complexes. *J. Biol. Chem.* **273**, 21443–21446.
- Poirier, M. A., Xiao, W., Macosko, J. C., Chan, C., Shin, Y. K., and Bennett, M. K. (1998). The synaptic SNARE complex is a parallel four-stranded helical bundle. *Nat. Struct. Biol.* **5**, 765–769.
- Poole, L. B., Chae, H. Z., Flores, B. M., Reed, S. L., Rhee, S. G., and Torian, B. E. (1997). Peroxidase activity of a TSA-like antioxidant protein from a pathogenic amoeba. *Free Radic. Biol. Med.* **23**, 955–959.
- Poon, R. Y., Lew, J., and Hunter, T. (1997). Identification of functional domains in the neuronal Cdk5 activator protein. *J. Biol. Chem.* **272**, 5703–5708.
- Pritham, E. J., Feschotte, C., and Wessler, S. R. (2005). Unexpected diversity and differential success of DNA transposons in four species of *Entamoeba* protozoans. *Mol. Biol. Evol.* **22**, 1751–1763.
- Purdy, J. E., Pho, L. T., Mann, B. J., and Petri, W. A., Jr. (1996). Upstream regulatory elements controlling expression of the *Entamoeba histolytica* lectin. *Mol. Biochem. Parasitol.* **78**, 91–103.

- Que, X., and Reed, S. L. (2000). Cysteine proteinases and the pathogenesis of amebiasis. *Clin. Microbiol. Rev.* **13**, 196–206.
- Quevillon, E., Spielmann, T., Brahim, K., Chattopadhyay, D., Yeramian, E., and Langsley, G. (2003). The *Plasmodium falciparum* family of Rab GTPases. *Gene* **306**, 13–25.
- Quon, D. V., Delgadillo, M. G., and Johnson, P. J. (1996). Transcription in the early diverging eukaryote *Trichomonas vaginalis*: An unusual RNA polymerase II and alpha-amanitin-resistant transcription of protein-coding genes. *J. Mol. Evol.* **43**, 253–262.
- Radhakrishna, H., and Donaldson, J. G. (1997). ADP-ribosylation factor 6 regulates a novel plasma membrane recycling pathway. *J. Cell Biol.* **139**, 49–61.
- Ramakrishnan, G., Lee, S., Mann, B. J., and Petri, W. A., Jr. (2000). *Entamoeba histolytica*: Deletion of the GPI anchor signal sequence on the Gal/GalNAc lectin light subunit prevents its assembly into the lectin heterodimer. *Exp. Parasitol.* **96**, 57–60.
- Ramakrishnan, G., Gilchrist, C. A., Musa, H., Torok, M. S., Grant, P. A., Mann, B. J., and Petri, W. A., Jr. (2004). Histone acetyltransferases and deacetylase in *Entamoeba histolytica*. *Mol. Biochem. Parasitol.* **138**, 205–216.
- Ramos, F., and Wiame, J. M. (1982). Occurrence of a catabolic L-serine (L-threonine) deaminase in *Saccharomyces cerevisiae*. *Eur. J. Biochem.* **123**, 571–576.
- Ramos, M. A., Mercado, G. C., Salgado, L. M., Sanchez-Lopez, R., Stock, R. P., Lizardi, P. M., and Alagón, A. (1997). *Entamoeba histolytica* contains a gene encoding a homologue to the 54 kDa subunit of the signal recognition particle. *Mol. Biochem. Parasitol.* **88**, 225–235.
- Ramponi, G., and Stefani, M. (1997). Structure and function of the low Mr phosphotyrosine protein phosphatases. *Biochim. Biophys. Acta* **1341**, 137–156.
- Randazzo, P. A., Terui, T., Sturch, S., Fales, H. M., Ferrige, A. G., and Kahn, R. A. (1995). The myristoylated amino terminus of ADP-ribosylation factor 1 is a phospholipid- and GTP-sensitive switch. *J. Biol. Chem.* **270**, 14809–14815.
- Ravdin, J. I., and Guerrant, R. L. (1981). Role of adherence in cytopathogenic mechanisms of *Entamoeba histolytica*. Study with mammalian tissue culture cells and human erythrocytes. *J. Clin. Invest.* **68**, 1305–1313.
- Ravdin, J. I., and Guerrant, R. L. (1982). Separation of adherence, cytolytic, and phagocytic events in the cytopathogenic mechanisms of *Entamoeba histolytica*. *Arch. Invest. Méd.* **13**, 123–128.
- Ravdin, J. I., Murphy, C. F., Guerrant, R. L., and Long-Krug, S. A. (1985). Effect of antagonists of calcium and phospholipase A on the cytopathogenicity of *Entamoeba histolytica*. *J. Infect. Dis.* **152**, 542–549.
- Reed, S., Bouvier, J., Sikes Pollack, A., Engel, J. C., Brown, M., Hirata, K., Que, X., Eakin, A., Hagblom, P., Gillin, F., and McKerrow, J. H. (1993). Cloning of a virulence factor of *Entamoeba histolytica*. Pathogenic strains possess a unique cysteine proteinase gene. *J. Clin. Invest.* **91**, 1532–1540.
- Reed, S. I. (1992). The role of p34 kinases in the G1 to S-phase transition. *Annu. Rev. Cell Biol.* **8**, 529–561.
- Reed, S. L., Keene, W. E., and McKerrow, J. H. (1989). Thiol proteinase expression and pathogenicity of *Entamoeba histolytica*. *J. Clin. Microbiol.* **27**, 2772–2777.
- Reeves, R. E. (1968). A new enzyme with the glycolytic function of pyruvate kinase. *J. Biol. Chem.* **243**, 3202–3204.
- Reeves, R. E. (1970). Phosphopyruvate carboxylase from *Entamoeba histolytica*. *Biochim. Biophys. Acta* **220**, 346–349.
- Reeves, R. E., Montalvo, F. E., and Lushbaugh, T. S. (1971). Nicotinamide-adenine dinucleotide phosphate-dependent alcohol dehydrogenase. Enzyme from *Entamoeba histolytica* and some enzyme inhibitors. *Int. J. Biochem.* **2**, 55–64.
- Reeves, R. E., and South, D. J. (1974). Phosphoglycerate kinase (GTP). An enzyme from *Entamoeba histolytica* selective for guanine nucleotides. *Biochem. Biophys. Res. Commun.* **58**, 1053–1057.

- Reeves, R. E., Serrano, R., and South, D. J. (1976). 6-phosphofructokinase (pyrophosphate). Properties of the enzyme from *Entamoeba histolytica* and its reaction mechanism. *J. Biol. Chem.* **251**, 2958–2962.
- Reeves, R. E., Warren, L. G., Susskind, B., and Lo, H. S. (1977). An energy-conserving pyruvate-to-acetate pathway in *Entamoeba histolytica*. Pyruvate synthase and a new acetate thiokinase. *J. Biol. Chem.* **252**, 726–731.
- Reeves, R. E. (1984). Metabolism of *Entamoeba histolytica* Schaudinn, 1903. *Adv. Parasitol.* **23**, 105–142.
- Reid, M. F., and Fewson, C. A. (1994). Molecular characterization of microbial alcohol dehydrogenases. *Crit. Rev. Microbiol.* **20**, 13–56.
- Rhee, S. G., Chae, H. Z., and Kim, K. (2005). Peroxiredoxins: A historical overview and speculative preview of novel mechanisms and emerging concepts in cell signaling. *Free Radic. Biol. Med.* **38**, 1543–1552.
- Richards, T. A., Hirt, R. P., Williams, B. A., and Embley, T. M. (2003). Horizontal gene transfer and the evolution of parasitic protozoa. *Protist* **154**, 17–32.
- Roberg, K. J., Crotwell, M., Espenshade, P., Gimeno, R., and Kaiser, C. A. (1999). LST1 is a SEC24 homologue used for selective export of the plasma membrane ATPase from the endoplasmic reticulum. *J. Cell Biol.* **145**, 659–672.
- Rodriguez-Romero, A., Hernandez-Santoyo, A., del Pozo Yauner, L., Kornhauser, A., and Fernandez-Velasco, D. A. (2002). Structure and inactivation of triosephosphate isomerase from *Entamoeba histolytica*. *J. Mol. Biol.* **322**, 669–675.
- Rodriguez, M. A., Baez-Camargo, M., Delgadillo, D. M., and Orozco, E. (1996). Cloning and expression of an *Entamoeba histolytica* NADP⁺-dependent alcohol dehydrogenase gene. *Biochim. Biophys. Acta* **1306**, 23–26.
- Rohmer, M., Knani, M., Simonin, P., Sutter, B., and Sahm, H. (1993). Isoprenoid biosynthesis in bacteria: A novel pathway for the early steps leading to isopentenyl diphosphate. *Biochem. J.* **295**, 517–524.
- Rosenbaum, R. M., and Wittner, M. (1970). Ultrastructure of bacterized and axenic trophozoites of *Entamoeba histolytica* with particular reference to helical bodies. *J. Cell Biol.* **45**, 367–382.
- Rotte, C., Stejskal, F., Zhu, G., Keithly, J. S., and Martin, W. (2001). Pyruvate: NADP⁺ oxidoreductase from the mitochondrion of *Euglena gracilis* and from the apicomplexan *Cryptosporidium parvum*: A biochemical relic linking pyruvate metabolism in mitochondriate and amitochondriate protists. *Mol. Biol. Evol.* **18**, 710–720.
- Rowe, J., Calegari, F., Taverna, E., Longhi, R., and Rosa, P. (2001). Syntaxin 1A is delivered to the apical and basolateral domains of epithelial cells: The role of munc-18 proteins. *J. Cell Sci.* **114**, 3323–3332.
- Roy, S. W., and Gilbert, W. (2005). The pattern of intron loss. *Proc. Natl. Acad. Sci. USA* **102**, 713–718.
- Rusnak, F., and Mertz, P. (2000). Calcineurin: Form and function. *Physiol. Rev.* **80**, 1483–1521.
- Saavedra, E., Olivos, A., Encalada, R., and Moreno-Sanchez, R. (2004). *Entamoeba histolytica*: Kinetic and molecular evidence of a previously unidentified pyruvate kinase. *Exp. Parasitol.* **106**, 11–21.
- Saavedra, E., Encalada, R., Pineda, E., Jasso-Chavez, R., and Moreno-Sanchez, R. (2005). Glycolysis in *Entamoeba histolytica*. Biochemical characterization of recombinant glycolytic enzymes and flux control analysis. *FEBS J.* **272**, 1767–1783.
- Saavedra Lira, E., Robinson, O., and Pérez Montfort, R. (1992). Partial nucleotide sequence of the enzyme pyruvate, orthophosphate dikinase of *Entamoeba histolytica* HM-1:IMSS. *Arch. Med. Res.* **23**, 39–40.
- Sahoo, N., Labruyere, E., Bhattacharya, S., Sen, P., Guillen, N., and Bhattacharya, A. (2004). Calcium binding protein 1 of the protozoan parasite *Entamoeba histolytica* interacts with actin and is involved in cytoskeleton dynamics. *J. Cell Sci.* **117**, 3625–3634.

- Said-Fernandez, S., and Lopez-Revilla, R. (1988). Free fatty acids released from phospholipids are the major heat-stable hemolytic factor of *Entamoeba histolytica* trophozoites. *Infect. Immun.* **56**, 874–879.
- Saito-Nakano, Y., Nakazawa, M., Shigeta, Y., Takeuchi, T., and Nozaki, T. (2001). Identification and characterization of genes encoding novel Rab proteins from *Entamoeba histolytica*. *Mol. Biochem. Parasitol.* **116**, 219–222.
- Saito-Nakano, Y., Yasuda, T., Nakada-Tsukui, K., Leippe, M., and Nozaki, T. (2004). Rab5-associated vacuoles play a unique role in phagocytosis of the enteric protozoan parasite *Entamoeba histolytica*. *J. Biol. Chem.* **279**, 49497–49507.
- Saito-Nakano, Y., Loftus, B. J., Hall, N., and Nozaki, T. (2005). The diversity of Rab GTPases in *Entamoeba histolytica*. *Exp. Parasitol.* **110**, 244–252.
- Salzberg, S. L., White, O., Peterson, J., and Eisen, J. A. (2001). Microbial genes in the human genome: Lateral transfer or gene loss? *Science* **292**, 1903–1906.
- Samarawickrema, N. A., Brown, D. M., Upcroft, J. A., Thammapalerd, N., and Upcroft, P. (1997). Involvement of superoxide dismutase and pyruvate:ferredoxin oxidoreductase in mechanisms of metronidazole resistance in *Entamoeba histolytica*. *J. Antimicrob. Chemother.* **40**, 833–840.
- Samuelson, J., Banerjee, S., Magnelli, P., Cui, J., Kelleher, D. J., Gilmore, R., and Robbins, P. W. (2005). The diversity of dolichol-linked precursors to Asn-linked glycans likely results from secondary loss of sets of glycosyltransferases. *Proc. Natl. Acad. Sci. USA* **102**, 1548–1553.
- Sanchez, L., Horner, D., Moore, D., Henze, K., Embley, T., and Müller, M. (2002). Fructose-1,6-bisphosphate aldolases in amitochondriate protists constitute a single protein subfamily with eubacterial relationships. *Gene* **295**, 51–59.
- Sanderfoot, A. A., Assaad, F. F., and Raikhel, N. V. (2000). The *Arabidopsis* genome. An abundance of soluble N-ethylmaleimide-sensitive factor adaptor protein receptors. *Plant Physiol.* **124**, 1558–1569.
- Sargeant, P. G., Williams, J. E., and Grene, J. D. (1978). The differentiation of invasive and non-invasive *Entamoeba histolytica* by isoenzyme electrophoresis. *Trans. R. Soc. Trop. Med. Hyg.* **72**, 519–521.
- Sargeant, P. G. (1987). The reliability of *Entamoeba histolytica* zymodemes in clinical diagnosis. *Parasitol. Today* **3**, 40–43.
- Sarti, P., Fiori, P. L., Forte, E., Rappelli, P., Teixeira, M., Mastronicola, D., Sanciu, G., Giuffrè, A., and Brunori, M. (2004). *Trichomonas vaginalis* degrades nitric oxide and expresses a flavorubredoxin-like protein: A new pathogenic mechanism? *Cell. Mol. Life Sci.* **61**, 618–623.
- Sata, M., Donaldson, J. G., Moss, J., and Vaughan, M. (1998). Brefeldin A-inhibited guanine nucleotide-exchange activity of Sec7 domain from yeast Sec7 with yeast and mammalian ADP ribosylation factors. *Proc. Natl. Acad. Sci. USA* **95**, 4204–4208.
- Satish, S., Bakre, A. A., Bhattacharya, S., and Bhattacharya, A. (2003). Stress-dependent expression of a polymorphic, charged antigen in the protozoan parasite *Entamoeba histolytica*. *Infect. Immun.* **71**, 4472–4486.
- Sawyer, M. K., Bischoff, J. M., Guidry, M. A., and Reeves, R. E. (1967). Lipids from *Entamoeba histolytica*. *Exp. Parasitol.* **20**, 295–302.
- Schimmoller, F., Singer-Kruger, B., Schroder, S., Kruger, U., Barlowe, C., and Riezman, H. (1995). The absence of Emp24p, a component of ER-derived COPII-coated vesicles, causes a defect in transport of selected proteins to the Golgi. *EMBO J.* **14**, 1329–1339.
- Schlessinger, J. (2000). Cell signaling by receptor tyrosine kinases. *Cell* **103**, 211–225.
- Schofield, P. J., and Edwards, M. R. (1994). Biochemistry—is *Giardia* opportunistic in its use of substrates? In “*Giardia: From Molecules to Disease*” (R. C. A. Thompson, J. A. Reynoldson, and A. J. Lymbery, eds.), pp. 171–183. CAB International, Wallingford, UK.

- Scholze, H., and Schulte, W. (1988). On the specificity of a cysteine proteinase from *Entamoeba histolytica*. *Biomed. Biochim. Acta* **47**, 115–123.
- Scholze, H., Lohden-Bendinger, U., Müller, G., and Bakker-Grunwald, T. (1992). Subcellular distribution of amebapain, the major cysteine proteinase of *Entamoeba histolytica*. *Arch. Med. Res.* **23**, 105–108.
- Schroeder, S. C., Schwer, B., Shuman, S., and Bentley, D. (2000). Dynamic association of capping enzymes with transcribing RNA polymerase II. *Genes Dev.* **14**, 2435–2440.
- Schroepfer, G. J., Jr. (1981). Sterol biosynthesis. *Annu. Rev. Biochem.* **50**, 585–621.
- Schulte, W., and Scholze, H. (1989). Action of the major protease from *Entamoeba histolytica* on proteins of the extracellular matrix. *J. Protozool.* **36**, 538–543.
- Seabra, M. C., Mules, E. H., and Hume, A. N. (2002). Rab GTPases, intracellular traffic and disease. *Trends Mol. Med.* **8**, 23–30.
- Shah, P. H., MacFarlane, R. C., Bhattacharya, D., Matese, J. C., Demeter, J., Stroup, S. E., and Singh, U. (2005). Comparative genomic hybridizations of *Entamoeba* strains reveal unique genetic fingerprints that correlate with virulence. *Eukaryot. Cell* **4**, 504–515.
- Sharma, R., Azam, A., Bhattacharya, S., and Bhattacharya, A. (1999). Identification of novel genes of non-pathogenic *Entamoeba dispar* by expressed sequence tag analysis. *Mol. Biochem. Parasitol.* **99**, 279–285.
- Shaywitz, D. A., Espenshade, P. J., Gimeno, R. E., and Kaiser, C. A. (1997). COPII subunit interactions in the assembly of the vesicle coat. *J. Biol. Chem.* **272**, 25413–25416.
- Shen, Z., and Jacobs-Lorena, M. (1999). Evolution of chitin-binding proteins in invertebrates. *J. Mol. Evol.* **48**, 341–347.
- Shire, A. M., and Ackers, J. P. (2007). SINE elements of *Entamoeba dispar*. *Mol. Biochem. Parasitol.* **152**, 47–52.
- Shiu, S. H., and Bleecker, A. B. (2001). Receptor-like kinases from *Arabidopsis* form a monophyletic gene family related to animal receptor kinases. *Proc. Natl. Acad. Sci. USA* **98**, 10763–10768.
- Shoemaker, N. B., Vlakamis, H., and Slyers, A. A. (2001). Evidence for extensive resistance gene transfer among *Bacteroides* spp., and among *Bacteroides* and other genera in the human colon. *Appl. Environ. Microbiol.* **67**, 561–568.
- Sies, H. (1999). Glutathione and its role in cellular functions. *Free Radic. Biol. Med.* **27**, 916–921.
- Silva, P. P., Martinez-Palomo, A., and Gonzalez-Robles, A. (1975). Membrane structure and surface coat of *Entamoeba histolytica*. Topochemistry and dynamics of the cell surface: Cap formation and microexudate. *J. Cell Biol.* **64**, 538–550.
- Simanis, V., and Nurse, P. (1986). The cell cycle control gene *cdc2⁺* of fission yeast encodes a protein kinase potentially regulated by phosphorylation. *Cell* **45**, 261–268.
- Singh, U., Purdy, J., Mann, B. J., and Petri, W. A., Jr. (1997). Three conserved cis-acting sequences in the core promoter control gene expression in the protozoan parasite *Entamoeba histolytica*. *Arch. Med. Res.* **28**(Spec No), 41–42.
- Singh, U., and Rogers, J. B. (1998). The novel core promoter element GAAC in the *hgl5* gene of *Entamoeba histolytica* is able to direct a transcription start site independent of TATA or initiator regions. *J. Biol. Chem.* **273**, 21663–21668.
- Singh, U., Gilchrist, C. A., Schaenman, J. M., Rogers, J. B., Hockensmith, J. W., Mann, B. J., and Petri, W. A. (2002). Context-dependent roles of the *Entamoeba histolytica* core promoter element GAAC in transcriptional activation and protein complex assembly. *Mol. Biochem. Parasitol.* **120**, 107–116.
- Snell, K. (1986). The duality of pathways for serine biosynthesis is a fallacy. *Trends Biochem. Sci.* **11**, 241–243.
- Springer, S., Chen, E., Duden, R., Marzioch, M., Rowley, A., Hamamoto, S., Merchant, S., and Schekman, R. (2000). The p24 proteins are not essential for vesicular transport in *Saccharomyces cerevisiae*. *Proc. Natl. Acad. Sci. USA* **97**, 4034–4039.

- Srivastava, G., Anand, M. T., Bhattacharya, S., and Bhattacharya, A. (1995). Lipophosphoglycan is present in distinctly different form in different *Entamoeba histolytica* strains and absent in *Entamoeba moshkovskii* and *Entamoeba invadens*. *J. Eukaryot. Microbiol.* **42**, 617–622.
- Stammes, M. A., and Rothman, J. E. (1993). The binding of AP-1 clathrin adaptor particles to Golgi membranes requires ADP-ribosylation factor, a small GTP-binding protein. *Cell* **73**, 999–1005.
- Stanley, S. L., Jr., Zhang, T., Rubin, D., and Li, E. (1995). Role of the *Entamoeba histolytica* cysteine proteinase in amebic liver abscess formation in severe combined immunodeficient mice. *Infect. Immun.* **63**, 1587–1590.
- Stark, M. J. (1996). Yeast protein serine/threonine phosphatases: Multiple roles and diverse regulation. *Yeast* **12**, 1647–1675.
- Strauss, E., Kinsland, C., Ge, Y., McLafferty, F. W., and Begley, T. P. (2001). Phosphopantothenoilcysteine synthetase from *Escherichia coli*. Identification and characterization of the last unidentified coenzyme A biosynthetic enzyme in bacteria. *J. Biol. Chem.* **276**, 13513–13516.
- Surana, U., Robitsch, H., Price, C., Schuster, T., Fitch, I., Fitcher, A. B., and Nasmyth, K. (1991). The role of CDC28 and cyclins during mitosis in the budding yeast *S. cerevisiae*. *Cell* **65**, 145–161.
- Susskind, B. M., Warren, L. G., and Reeves, R. E. (1982). A pathway for the interconversion of hexose and pentose in the parasitic amoeba *Entamoeba histolytica*. *Biochem. J.* **204**, 191–196.
- Swain, A. L., Jaskolski, M., Housset, D., Rao, J. K., and Wlodawer, A. (1993). Crystal structure of *Escherichia coli* L-asparaginase, an enzyme used in cancer therapy. *Proc. Natl. Acad. Sci. USA* **90**, 1474–1478.
- Sykes, D. E., and Band, R. N. (1977). Superoxide dismutase and peroxide activity of *Acanthamoeba* and two anaerobic *Entamoeba* species. *J. Cell Biol.* **75**, 85a.
- Takeuchi, T., Weinbach, E. C., and Diamond, L. S. (1977). *Entamoeba histolytica*: Localization and characterization of phosphorylase and particulate glycogen. *Exp. Parasitol.* **43**, 107–114.
- Takeuchi, T., Weinbach, E. C., Gottlieb, M., and Diamond, L. S. (1979). Mechanism of L-serine oxidation in *Entamoeba histolytica*. *Comp. Biochem. Physiol. B Comp. Biochem.* **62**, 281–285.
- Talamas-Rohana, P., Aguirre-Garcia, M. M., Anaya-Ruiz, M., and Rosales-Encina, J. L. (1999). *Entamoeba dispar* contains but does not secrete acid phosphatase as does *Entamoeba histolytica*. *Exp. Parasitol.* **92**, 219–222.
- Tannich, E., Bruchhaus, I., Walter, R. D., and Horstmann, R. D. (1991a). Pathogenic and nonpathogenic *Entamoeba histolytica*: Identification and molecular cloning of an iron-containing superoxide dismutase. *Mol. Biochem. Parasitol.* **49**, 61–71.
- Tannich, E., Ebert, F., and Horstmann, R. D. (1991b). Primary structure of the 170-kDa surface lectin of pathogenic *Entamoeba histolytica*. *Proc. Natl. Acad. Sci. USA* **88**, 1849–1853.
- Tannich, E., Scholze, H., Nickel, R., and Horstmann, R. D. (1991c). Homologous cysteine proteinases of pathogenic and nonpathogenic *Entamoeba histolytica*. Differences in structure and expression. *J. Biol. Chem.* **266**, 4798–4803.
- Tannich, E., Nickel, R., Buss, H., and Horstmann, R. D. (1992). Mapping and partial sequencing of the genes coding for two different cysteine proteinases in pathogenic *Entamoeba histolytica*. *Mol. Biochem. Parasitol.* **54**, 109–111.
- Temesvari, L. A., Harris, E. N., Stanley, J. S. L., and Cardellia, J. A. (1999). Early and late endosomal compartments of *Entamoeba histolytica* are enriched in cysteine proteases, acid phosphatase and several Ras-related Rab GTPases. *Mol. Biochem. Parasitol.* **103**, 225–241.
- Todd, J., Post-Beittenmiller, D., and Jaworski, J. G. (1999). KCS1 encodes a fatty acid elongase 3-ketoacyl-CoA synthase affecting wax biosynthesis in *Arabidopsis thaliana*. *Plant J.* **17**, 119–130.
- Tokoro, M., Asai, T., Kobayashi, S., Takeuchi, T., and Nozaki, T. (2003). Identification and characterization of two isoenzymes of methionine γ -lyase from *Entamoeba histolytica*: A key enzyme of sulfur-amino acid degradation in an anaerobic parasitic protist that lacks forward and reverse trans-sulfuration pathways. *J. Biol. Chem.* **278**, 42717–42727.

- Toonen, R. F., and Verhage, M. (2003). Vesicle trafficking: Pleasure and pain from SM genes. *Trends Cell Biol.* **13**, 177–186.
- Torii, S., Takeuchi, T., Nagamatsu, S., and Izumi, T. (2004). Rab27 effector granuphilin promotes the plasma membrane targeting of insulin granules via interaction with syntaxin 1a. *J. Biol. Chem.* **279**, 22532–22538.
- Touz, M. C., Nores, M. J., Slavin, I., Carmona, C., Conrad, J. T., Mowatt, M. R., Nash, T. E., Coronel, C. E., and Lujan, H. D. (2002). The activity of a developmentally regulated cysteine proteinase is required for cyst wall formation in the primitive eukaryote *Giardia lamblia*. *J. Biol. Chem.* **277**, 8474–8481.
- Tovar, J., Fischer, A., and Clark, C. G. (1999). The mitosome, a novel organelle related to mitochondria in the amitochondriate parasite *Entamoeba histolytica*. *Mol. Microbiol.* **32**, 1013–1021.
- Trilla, J. A., Duran, A., and Roncero, C. (1999). Chs7p, a new protein involved in the control of protein export from the endoplasmic reticulum that is specifically engaged in the regulation of chitin synthesis in *Saccharomyces cerevisiae*. *J. Cell Biol.* **145**, 1153–1163.
- Trombetta, E. S., and Parodi, A. J. (2003). Quality control and protein folding in the secretory pathway. *Annu. Rev. Cell Dev. Biol.* **19**, 649–676.
- Tye, B. K. (1999). MCM proteins in DNA replication. *Annu. Rev. Biochem.* **68**, 649–686.
- Uemura, T., Ueda, T., Ohniwa, R. L., Nakano, A., Takeyasu, K., and Sato, M. H. (2004). Systematic analysis of SNARE molecules in *Arabidopsis*: Dissection of the post-Golgi network in plant cells. *Cell Struct. Funct.* **29**, 49–65.
- Uwanogho, D. A., Hardcastle, Z., Balogh, P., Mirza, G., Thornburg, K. L., Ragoussis, J., and Sharpe, P. T. (1999). Molecular cloning, chromosomal mapping, and developmental expression of a novel protein tyrosine phosphatase-like gene. *Genomics* **62**, 406–416.
- Van Dellen, K., Field, J., Wang, Z., Loftus, B., and Samuelson, J. (2002a). LINEs and SINE-like elements of the protist *Entamoeba histolytica*. *Gene* **297**, 229–239.
- Van Dellen, K., Ghosh, S. K., Robbins, P. W., Loftus, B., and Samuelson, J. (2002b). *Entamoeba histolytica* lectins contain unique 6-Cys or 8-Cys chitin-binding domains. *Infect. Immun.* **70**, 3259–3263.
- Van Dellen, K. L., Bulik, D. A., Specht, C. A., Robbins, P. W., and Samuelson, J. C. (2006a). Heterologous expression of an *Entamoeba histolytica* chitin synthase in *Saccharomyces cerevisiae*. *Eukaryot. Cell* **5**, 203–206.
- Van Dellen, K. L., Chatterjee, A., Ratner, D. M., Magnelli, P. E., Cipollo, J. F., Steffen, M., Robbins, P. W., and Samuelson, J. (2006b). Unique posttranslational modifications of chitin-binding lectins of *Entamoeba invadens* cyst walls. *Eukaryot. Cell* **5**, 836–848.
- van der Giezen, M., Cox, S., and Tovar, J. (2004). The iron–sulfur cluster assembly genes *iscS* and *iscU* of *Entamoeba histolytica* were acquired by horizontal gene transfer. *BMC Evol. Biol.* **4**, 7.
- Van Mullem, V., Wery, M., Werner, M., Vandenhoute, J., and Thuriaux, P. (2002). The Rpb9 subunit of RNA polymerase II binds transcription factor TFIIE and interferes with the SAGA and elongator histone acetyltransferases. *J. Biol. Chem.* **277**, 10220–10225.
- Vanacova, S., Liston, D. R., Tachezy, J., and Johnson, P. J. (2003). Molecular biology of the amitochondriate parasites, *Giardia intestinalis*, *Entamoeba histolytica* and *Trichomonas vaginalis*. *Int. J. Parasitol.* **33**, 235–255.
- Vandepoele, K., Raes, J., De Veylder, L., Rouze, P., Rombauts, S., and Inze, D. (2002). Genome-wide analysis of core cell cycle genes in *Arabidopsis*. *Plant Cell* **14**, 903–916.
- Varela-Gomez, M., Moreno-Sanchez, R., Pardo, J. P., and Perez-Montfort, R. (2004). Kinetic mechanism and metabolic rôle of pyruvate phosphate dikinase from *Entamoeba histolytica*. *J. Biol. Chem.* **279**, 54124–54130.
- Vargas-Villarreal, J., Olvera-Rodriguez, A., Mata-Cardenas, B. D., Martinez-Rodriguez, H. G., Said-Fernandez, S., and Alagon-Cano, A. (1998). Isolation of an *Entamoeba histolytica* intracellular alkaline phospholipase A2. *Parasitol. Res.* **84**, 310–314.

- Vargas, M., Sansonetti, P., and Guillen, N. (1996). Identification and cellular localization of the actin-binding protein ABP-120 from *Entamoeba histolytica*. *Mol. Microbiol.* **22**, 849–857.
- Vartiainen, M. K., and Machesky, L. M. (2004). The WASP-Arp2/3 pathway: Genetic insights. *Curr. Opin. Cell Biol.* **16**, 174–181.
- Vats, D., Vishwakarma, R. A., Bhattacharya, S., and Bhattacharya, A. (2005). Reduction of cell surface glycosylphosphatidylinositol conjugates in *Entamoeba histolytica* by antisense blocking of *E. histolytica* GlcNAc-phosphatidylinositol deacetylase expression: Effect on cell proliferation, endocytosis, and adhesion to target cells. *Infect. Immun.* **73**, 8381–8392.
- Vayssie, L., Vargas, M., Weber, C., and Guillen, N. (2004). Double-stranded RNA mediates homology-dependent gene silencing of gamma-tubulin in the human parasite *Entamoeba histolytica*. *Mol. Biochem. Parasitol.* **138**, 21–28.
- Villalobo, E., Wender, N., and Mirelman, D. (2005). *Entamoeba histolytica*: Molecular characterization of an aldose 1-epimerase (mutarotase). *Exp. Parasitol.* **110**, 298–302.
- Vishwakarma, R. A., Anand, M. T., Arya, R., Vats, D., and Bhattacharya, A. (2006). Glycosylated inositol phospholipid from *Entamoeba histolytica*: Identification and structural characterization. *Mol. Biochem. Parasitol.* **145**, 121–124.
- Volpicelli-Daley, L. A., Li, Y., Zhang, C. J., and Kahn, R. A. (2005). Isoform-selective effects of the depletion of ADP-ribosylation factors 1–5 on membrane traffic. *Mol. Biol. Cell* **16**, 4495–4508.
- Vowels, J. J., and Payne, G. S. (1998). A dileucine-like sorting signal directs transport into an AP-3-dependent, clathrin-independent pathway to the yeast vacuole. *EMBO J.* **17**, 2482–2493.
- Walenta, J. H., Didier, A. J., Liu, X., and Kramer, H. (2001). The Golgi-associated hook3 protein is a member of a novel family of microtubule-binding proteins. *J. Cell Biol.* **152**, 923–934.
- Wang, C. C., and Cheng, H. W. (1984). The deoxyribonucleoside phosphotransferase of *Trichomonas vaginalis*. A potential target for anti-trichomonal chemotherapy. *J. Exp. Med.* **160**, 987–1000.
- Wang, Z., Samuelson, J., Clark, C. G., Eichinger, D., Paul, J., Van Dellen, K., Hall, N., Anderson, I., and Loftus, B. (2003). Gene discovery in the *Entamoeba invadens* genome. *Mol. Biochem. Parasitol.* **129**, 23–31.
- Wassmann, C., Hellberg, A., Tannich, E., and Bruchhaus, I. (1999). Metronidazole resistance in the protozoan parasite *Entamoeba histolytica* is associated with increased expression of iron-containing superoxide dismutase and peroxiredoxin and decreased expression of ferredoxin 1 and flavin reductase. *J. Biol. Chem.* **274**, 26051–26056.
- Watson, W. H., Yang, X., Choi, Y. E., Jones, D. P., and Kehrer, J. P. (2004). Thioredoxin and its role in toxicology. *Toxicol. Sci.* **78**, 3–14.
- Weber, C., Guigon, G., Bouchier, C., Frangeul, L., Moreira, S., Sismeiro, O., Gouyette, C., Mirelman, D., Coppee, J. Y., and Guillen, N. (2006). Stress by heat shock induces massive down regulation of genes and allows differential allelic expression of the Gal/GalNAc lectin in *Entamoeba histolytica*. *Eukaryot. Cell* **5**, 871–875.
- Wegmann, D., Hess, P., Baier, C., Wieland, F. T., and Reinhard, C. (2004). Novel isotypic gamma/zeta subunits reveal three coatomer complexes in mammals. *Mol. Cell. Biol.* **24**, 1070–1080.
- Weinbach, E. C., and Diamond, L. S. (1974). *Entamoeba histolytica*. I. Aerobic metabolism. *Exp. Parasitol.* **35**, 232–243.
- Weinberg, M. V., Jenney, F. E., Jr., Cui, X., and Adams, M. W. (2004). Rubrerythrin from the hyperthermophilic archaeon *Pyrococcus furiosus* is a rubredoxin-dependent, iron-containing peroxidase. *J. Bacteriol.* **186**, 7888–7895.
- Wennerberg, K., Rossman, K. L., and Der, C. J. (2005). The Ras superfamily at a glance. *J. Cell Sci.* **118**, 843–846.