

KEPUSTAKAAN

- Ahmad, S., 2011. Pathogenesis, immunology, and diagnosis of latent *Mycobacterium tuberculosis* infection. *Clinical and Developmental Immunology*. ID. 814943.
- Akhter, Y., Ehebauer, M., Mukhopadhyay and Hasnain, S.E., 2012. The *PE/PPE* multigene family codes for virulence factors and is a possible source of mycobacterial antigenic variation: Perhaps more?. *Biochimie*. 94 : 110 – 6.
- Anh, D. D., Borgdorff, M.W., Van, L.N., Lan, N.T.N., van Gorkom, T., Kremer, K and van Soolingen, D., 2000. *Mycobacterium tuberculosis* Beijing genotype emerging in Vietnam. *Emerg. Infect. Dis*. 6 : 302 - 5.
- Av-Gay, Y, and M. Everett. 2000. The eukaryotic-like Ser/Thr protein kinases of *Mycobacterium tuberculosis*. *Trends Microbiol*. 8: 238–44.
- Attardi, G., 1967. The Mechanism of Protein Synthesis. *Annual Review of Microbiology*. 21: 383-416.
- Banu, S., Honore, N., Saint-Joanis, B., Philpott, D., Prevost, M.C., Cole, S.T., 2002. Are the PE-PGRS proteins of *Mycobacterium tuberculosis* variable surface antigens? *Mol Microbiol*. 44 : 9–19.
- Betts, J.C., Lukey, P.T., Robb, L.C., McAdam, R.A and Duncan, K., 2002., Evaluation of a nutrient starvation model of *Mycobacterium tuberculosis* persistence by gene and protein expression profiling. *Mol Microbiol* 43: 717-31
- Belanger, A. E., and G. F. Hatfull. 1999. Exponential-phase glycogen recycling is essential for growth of *Mycobacterium smegmatis*. *J. Bacteriol*. 181: 6670 – 8.
- Besra, G. S., and P. J. Brennan. 1997. The mycobacterial cell wall: biosynthesis of arabinogalactan and lipoarabinomannan. *Biochem. Soc Trans*. 25: 845 – 50.
- Bowie, J. U., Reidhaar-Olson, J. F., Lim, W. A and Sauer, R. T., 1990. Deciphering the message in protein sequences: tolerance to amino acid substitutions. *Science*. 247 : 1306-1310.
- Boon, C and Dick, T., 2002. *Mycobacterium bovis* BCG Response Regulator Essential for Hypoxic Dormancy. *J. Bacteriol*. 184: 6760-7
- Branden, C.I. and Tooze, J., 1999. Introduction to Protein Structure, 2nd. ed. Garland. New York.
- Brennan, M. J., and G. Delogu., 2002. The PE multigene family: a ‘molecular mantra’ for mycobacteria. *Trends Microbiol*. 10: 246–9.
- Brennan, M., Delogu, G., Chen, Y., Bardarov, S., Kriakov, ., Alavi, M and Jacobs, W.R., 2001. Evidence that Mycobacterial PE_PGRS Proteins Are Cell

Surface Constituents That Influence Interactions with Other Cells. *Infect. Immun.* 69 : 7326 – 33.

- Brooks, G., Carrol, K.C., Butel, J., Morse, S and Mietzer, T., Jawetz, Melnick, & Adelberg's Medical Microbiology 25th ed. McGraw Hill Medical. Ney York.
- Brosch, R., Gordon, S.V., Brodin, P., C. Buchrieser, C., Eiglmeier, K., Garnier, T., Gutierrez, C., Hewinson, G., Kremer, K., Parsons, L.M., Pym, A.S., Samper, S., van Soolingen, D and Cole, S.T., 2002. A new evolutionary scenario for the *Mycobacterium tuberculosis complex*. *PNAS.* 99 : 3684 – 9.
- Bruell, C.M., 1977. Mechanism of protein synthesis in *Mycobacterium smegmatis*. Diss. ETH No. 17733.
- Campuzano, J., Aquilar, D., Arriaga, K., Leon, J.C., Salas-Rangel, L.P., Gonzales-Merchand, J., Hernandez-Pando, R and Espitia, C., 2007. The PGRS domain of *Mycobacterium tuberculosis* PE PGRS Rv1759c antigen is an efficient subunit vaccine to prevent reactivation in a murine model of chronic tuberculosis. *Vaccine.* 25 : 3722–9
- Canaday, D.H., Ziebold, C., Noss, E.H., Chervenak, K.A., Harding, C.V., dan Boom, W.H., 1999. Activation of Human CD8⁺ $\alpha\beta$ TCR⁺ Cells by *Mycobacterium tuberculosis* Via an Alternate Class I MHC Antigen-Processing Pathway. *J. Immunol.* 162: 372–379.
- Cascioferro, A., Daleke, M.H., Ventura, M., Dona, V., Delogu, G., Palu, G., Bitter, W and Manganelli, R., 2010. Functional Dissection of the PE Domain Responsible for Translocation of PE_PGRS33 across the *Mycobacterial* Cell Wall. *Plos One.* 6 : e27713.
- Castro-Obregon, S. 2010. The Discovery of Lysosomes and Autophagy. *Nature Education* 3:49 – 53.
- Cousins, D., Williams, S., Liebana, E., Aranaz, A., Bunschoten, A., Van Embden, J and Ellis, T., 1998. Evaluation of four DNA typing techniques in epidemiological investigations of bovine tuberculosis. *J Clin Microbiol* 36: 168-78.
- Chaturvedi, E., Bansal, K., Narayana, Y., Kapur, N., Sakumar, N., Togarsimalemath, S.K., Mishra, S., Ajitkumar, P., oshi, B., Katoch, V, M., Patil, S.A and Balaji, K.N., 2010. The Multifunctional PE_PGRS11 Protein from *Mycobacterium tuberculosis* Plays a Role in Regulating Resistance to Oxidative Stress *J Biol Chem.* 285: 30389 – 403.
- Chatterjee, D., Lowell, K., Rivoire, B., McNeil, M.R and Brennan, P., 1992. Lipoarabinomannan of *Mycobacterium tuberculosis*. Capping with mannosyl residues in some strains. *J. Biol. Chem.* 267: 6234 – 39.
- Chauhan, A., H. Lofton, E. Maloney, J. Moore, M. Fol, M. V. Madiraju, and M. Rajagopalan. 2006. Interference of *Mycobacterium tuberculosis* cell division by Rv2719c, a cell wall hydrolase. *Mol. Microbiol.* 62:132–47.

- Chen, Y.C., Hsiao, C.C., Chen, C.J., Chin, C.H., Liu, C.C., Wu, C.C., Eng, H.L., Chao, T.Y., Tsen, C.C., Wang, Y.H and Lin, M.C., 2010. Toll-like receptor 2 gene polymorphisms, pulmonary tuberculosis, and natural killer cell counts. *BMC Medical Genetics*. 11 : 1 – 10.
- Cheng, J., Sweredowski, M and Baldi, P., 2005. DOMpro: Protein Domain Prediction Using Profiles, Secondary Structure, Relative Solvent Accessibility, and Recursive Neural Networks. *Data Mining and Knowledge Discovery*. 13: 1–10.
- Chothial, C and Lesk, A.M., 1986. The relation between the divergence of sequence and structure in proteins. *The EMBO Journal*. 5 : 823-6.
- Chronos, Z.C., Midde, K., Sever-Chroneos, Z and Jagannath, C., 2009. Pulmonary surfactant and tuberculosis. *Tuberculosis*. Suppl 1: S10-4.
- Colangeli, R., Haq, A., Arcus, V.L., Summers, E., Magliozzo, R.S., McBride, A., Mitra, A.K., Radjainia, M., Khajo, A., Jacobs Jr, W.R., Salgame, P and Alland, D., 2009. The multifunctional histone-like protein Lsr2 protects *Mycobacteria* against reactive oxygen intermediates. *PNAS*. 106 : 4414-18.
- Cole, S.T., 1999. Learning from the genome sequence of *Mycobacterium tuberculosis* H37Rv. *FEBS Lett*. 452: 7-10.
- Cole, S.T., Brosch, R., Parkhill, J., Garnier, T., Churcher, C., Harris, D., Gordon, S.V., Eiglmeier, K., Gas, S., Barry, C.E., Tekaia, F., Badcock, K., Basham, D., Brown, D., Chillingworth, T., Connor, R., Davies, R., Devlin, K., Feltwell, T., Gentles, S., Hamlin, N., Holroyd, S., Hornsby, T., Jagels, K., Krogh, A., McLean, J., Moule, S., Murphy, L., Oliver, K., Osborne, J., Quail, M.A., Rajandream, M.A., Rogers, J., Rutter, S., Seeger, K., Skelton, J., Squares, R., Squares, S., Sulston, J.E., Taylor, K., Whitehead, S and Barrell, B.G., 1998. Deciphering the biology of *Mycobacterium tuberculosis* from the complete genome. *Nature*. 393: 537–544.
- Comas, I., Coscolla, M., Luo, T., Borrell, S., Holt, K.E., Kato-Maeda, M., Parkhill, J., Malla B, Berg S, Thwaites G, Yeboah-Manu D, Bothamley G, Mei, J., Wei, L., Bentley, S., Harris, S.R., Niemann, S., Diel, R., Aseffa, A., Gao, Q., Young, D., Gagneux S., 2013. Out-of-Africa migration and Neolithic coexpansion of *Mycobacterium tuberculosis* with modern humans. *Nat. Genet*. 45:1176–1182.
- Cooper, A.M and Torrado, E., 2012. Protection versus pathology in tuberculosis: recent insights. *Current Opinion in Immunology*. 24:1–7
- Copin, R., Coscolla, M., Salome, N et al., Sequence Diversity in the pe_pgrs Genes of *Mycobacterium tuberculosis* Is Independent of Human T Cell Recognition
- Corbett, E. L., Watt, C.J., Walker, N., Maher, D., Williams, B.G., Raviglione, M.C and Dye, C., 2003. The growing burden of tuberculosis: global trends and interactions with the HIV epidemic. *Arch. Intern. Med*. 163: 1009–1021.

- Cowley, S.C and Elkins, K.E., 2003. CD4⁺ T Cells Mediate IFN- γ Independent Control of *Mycobacterium tuberculosis* Infection Both In Vitro and In Vivo. *J. Immunol.* 171: 4689–99.
- Crevel, RV., Ottenhoff, T.H.M and Meer, J.W.M., 2002. Innate immunity to *Mycobacterium tuberculosis*. *Clin.Microbiol. Rev.* 15: 294 – 309.
- Crick, D.C., Mahapatra, S and Brennan, P.J., 2001. Biosynthesis of the arabinogalactan-peptidoglycan complex of *Mycobacterium tuberculosis*. *Glycobiology.* 11: 107R – 8R.
- Cuervo, A.M. and Dice, J.F., 1998. Lysosomes, a meeting point of proteins, chaperones, and proteases. *J Mol Med.* 76: 6-12.
- Dasgupta, A., P. Datta, M. Kundu, and J. Basu. 2006. The serine/threonine kinase PknB of *Mycobacterium tuberculosis* phosphorylates PBPA, a penicillin-binding protein required for cell division. *Microbiology* 152:493–504
- Datta, P., Dasgupta, A., Singh, A.K., Mukherjee, P., Kundu, M and Basu., 2006. Interaction between FtsW and penicillin-binding protein 3 (PBP3) directs PBP3 to mid-cell, controls cell septation and mediates the formation of a trimeric complex involving FtsZ, FtsW and PBP3 in mycobacteria. *Mol.Microbiol.* 62:1655–1673.
- David, Y., Ziv, T and Navon, A., 2010. The E2 Ubiquitin-conjugating Enzymes Direct Polyubiquitination to Preferred Lysines. *J Biol Chem.* 285: 8595–8604
- Departemen Kesehatan RI., 2011. Pedoman Nasional Penanggulangan Tuberkulosis di Indonesia. Depkes RI.Jakarta.
- Delogu, G., Pusceddu, C., Bua, A., Fadda, G., Brennan, M. and Zatetti, S., 2004. Rv1818c-encoded PE_PGRS protein of *Mycobacterium tuberculosis* is surface exposed and influences bacterial cell structure. *Mol. Microbiol.* 52 : 725 – 33.
- Delogu, G., Sanguinetti, M., Pusceddu, C., Bua, A., Brennan, M.J., Zanetti, S and Fadda, G., 2006. PE_PGRS proteins are differentially expressed by *Mycobacterium tuberculosis* in host tissues. *Microbes Infect.* 8: 206-17.
- Deng, L. L., Humphries, D.E., Arbeit, R.D., Carlton, L.E., Smole, S.C and Carroll, .D., 2005. Identification of a novel peptidoglycan hydrolase CwlM in *Mycobacterium tuberculosis*. *Biochim. Biophys. Acta.* 1747: 57 – 66.
- Deretic, V., Singh, S., Master, S., Harris, J., Roberts, E., Kyei, G., Davis, A., deHaro, S., Naylor, J., Lee, H.H and Vergne, I., 2006. *Mycobacterium tuberculosis* inhibition of phagolysosome biogenesis and autophagy as a host defence mechanism. 8 :719-27.

- Dheenadhayalan, V., Delogu, G., Sanguinetti, M., Fadda, G and Brennan, P., 2006. Variable Expression Patterns of *Mycobacterium tuberculosis* PE_PGRS Genes: Evidence that PE_PGRS16 and PE_PGRS26 Are Inversely Regulated In Vivo. *J Bacteriol.* 188: 3721 – 25.
- Dorhoi, A., Reece, S.T and Kaufmann, S.H., 2011. For better or for worse: the immune response against *Mycobacterium tuberculosis* balances pathology and protection. *Immunol Rev.* 240: 235-51.
- Dubnau, E., Fontan, P., Manganelli, R., Soares-Appel, S and Smith, I., 2002. *Mycobacterium tuberculosis* Genes Induced during Infection of Human Macrophages. *Infect. Immun.* 70 : 2787 – 95.
- Eisenhaber, F and Bork, P., 1999. Sequence and structure protein. In : *Biotechnology* 2nd ed. Wiley-VCH. New York.
- Espitia, C., Laclette, J.P., Mondragon-Palomino, M., Amador, A., Campuzano, J., Martens, A., 1999. The PE-PGRS-glycine-rich proteins *Mycobacterium tuberculosis*: a new family of fibronectin-binding proteins? *Microbiology* 145:3487–895
- Ewann, F., M. Jackson, K. Pethe, A. Cooper, N. Mielcarek, D. Ensergueix, B. Gicquel, C. Locht, and P. Supply., 2002. Transient requirement of the PrrA-PrrB two-component system for early intracellular multiplication of *Mycobacterium tuberculosis*. *Infect. Immun.* 70 : 2256– 63.
- Frothingham, R and Meeker-O’Connell, WA., 1998. Genetic diversity in the *Mycobacterium tuberculosis* complex based on variable numbers of tandem DNA repeats. *Microbiology* 144: 1189 - 196.
- Ferrari, G., Langen, H., Naito, M and Pieters, J., 1999. A coat protein on phagosomes involved in the intracellular survival of mycobacteria. *Cell.* 97: 435–47.
- Filliol, I., Driscoll, J.R., van Soolingen, D., Kreiswirth, B.N., Kremer, K., Valetudie, G., Anh, D.D., Barlow, R., Banerjee, P., Bifani, P.J., 2003. Snapshot of Moving and Expanding Clones of *Mycobacterium tuberculosis* and Their Global Distribution Assessed by Spoligotyping in an International Study. *Clin Microbiol.* 41 : 1963 – 70.
- Fisher, M.A, Plikaytis, B.B and Shinnick, T.M., 2002. Microarray analysis of the *Mycobacterium tuberculosis* transcriptional response to the acidic conditions found in phagosomes. *J Bacteriol* 184: 4025-32.
- Garcia-Romo, G.S., Pedroza-Gonzalez, A., Aguilar-Leon, D., Orozco-Estevez, H., Lambrecht, B.N., Estrada-Garcia, I., Flores-Romo, L and Hernández-Pando, R., 2004. Airways infection with virulent *Mycobacterium tuberculosis* delays the influx of dendritic cells and the expression of costimulatory molecules in mediastinal lymph nodes. *Immunology.* 112 : 661 – 8.
- Garnier, T., Eiglmeier, K., Camus, J-C., Medina, N., Mansoor, H., Pryor, M., Duthoy, S., Grondin, S., Lacroix, C., Monsempe, C., Simon, S., Harris, B., Atkin, R.,

- Doggett, J., Mayes, R., Keating, L., Wheeler, P.R., Parkhill, J., Bart, G., Stewart, B., Cole, T., Gordon, S.V and Hewinson, R.G., 2003. The complete genome sequence of *Mycobacterium bovis*. PNAS. 100 : 7877 – 82.
- Gutierrez, M.G., Master, S.S., Singh, S.B., Taylor, G.A., Colombo, M.I and Deretic, V., 2004. Autophagy is a defense mechanism inhibiting BCG and *Mycobacterium tuberculosis* survival in infected macrophages. Cell.119: 753-66.
- Gupta, N., Salam, N., Srivastava, V., Singla, R., Behera, D., Khayyam, K.U., Korde, R., Malhotra, P., Saxena, R and Natarajan, K., Voltage Gated Calcium Channels Negatively Regulate Protective Immunity to *Mycobacterium tuberculosis*. Plos ONE. 4: e5305.
- Hett, E.C and Rubin, E.J., 2008. Bacterial Growth and Cell Division: a Mycobacterial Perspective. *Microbiol and Mol biology*. 72 : 126–56.
- Hanekom, M., van der Spuy, G.D., Streicher, E., Ndbambi, S.L., McEvoy, C.R.E., Kidd, M., Beyers, T., Victor, T.C., van Helden, P.D and Warren, R.M., 2007. A Recently Evolved Sublineage of the *Mycobacterium tuberculosis* Beijing Strain Family Is Associated with an Increased Ability to Spread and Cause Disease. *J. Clin. Microbiol*. 45: 1483 – 90.
- He, H., Hovey, R., Kane, ., Singh, V and Tzahrt, T.C., 2006. MprAB is a stress-responsive two-component system that directly regulates expression of sigma factors SigB and SigE in *Mycobacterium tuberculosis*. *J. Bacteriol*. 188:2134–43.
- Hershko, A and Ciechanover, A., 1998. The ubiquitin system. *Annu Rev Biochem* 67: 425–479
- Jackett, P.S., Bothamley, G.H., Batra, H.V et al., 1988. Specificity of antibodies to immunodominant mycobacterial antigens in pulmonary tuberculosis. *J Clin Microbiol*. 26 : 2313 – 8.
- Kamerbeek, J., Scouls, L., Kolk, A., van Agterveld, M., van Solingen, D., Kuijper, S., Bunschoten, A., Molhouizen, H., Shaw, R., Goyal, M and van Embden, J., 1997. Simultaneous Detection and Strain Differentiation of *Mycobacterium tuberculosis* for Diagnosis and Epidemiology. *J Clin Microbiol*. 35 : 907 – 914.
- Kang, D.D., Lin, Y., Moreno, J-R., Randall, T.D and Khader, S.A., 2011. Profiling Early Lung Immune Responses in the Mouse Model of Tuberculosis. Plos ONE. 6: e16161.
- Karboul, A., van Pitius, N.C.G., Namouchi, A., Vincent, V., Sola, C., Rastogi, N., Suffys, P., Fabre, M., Cataldi, A., Huard, R.C., Kurepina, N., Kreiswirth, B., Ho, J.L., Gutierrez, M.C and Mardassi, H., 2006. Insights into the evolutionary history of tubercle bacilli as disclosed by genetic rearrangements within a PE_PGRS duplicated gene pair. *BMC Evolutionary Biology*. 1 -18.

- Kaufman, S.H.E., 2002. Protection againts tuberculosis: cytokines, T cells, and macrophages. *Ann.Rheum. Dis.* 61: 54 – 8.
- Kauffman, S.H.E., 2011. Fact and fiction in tuberculosis vaccine research: 10 years later. *Lancet Infect Dis.* 11: 633–40.
- Kirisako, T., Kamei, K., Murata, S., Kato, M., Fukumoto, H., Kanie, M., Sano, S., Tokunaga, F., Tanaka, K and Iwai, K., 2006. A ubiquitin ligase complex assembles linear polyubiquitin chains. *The EMBO Journal* 25 : 4877–4887
- Kishore, U., Greenhough, T.J., Waters, P., Shrive, A.K., Ghai, R., Kamran, M.F., Bernal, A.L., Reid, K.B., Madan, T and Chakraborty, T., 2006. Surfactant proteins SP-A and SP-D: structure, function and receptors. *Mol Immunol.* 43 : 1293 – 315.
- Kleinnijenhuis, J., Oosting, M., Joosten, L.A.B., Netea, M.G and Van Crevel, R., 2011. Innate Immune Recognition of *Mycobacterium tuberculosis*. *Clinn Dev Immunol.* ID:405310.
- Irawan, B., 2008. Genetika Molekuler. Airlangga University Press. Surabaya.
- Ivanyi J., 2014. Function and potentials of M. Tuberculosis epitopes. *Microbiol Immunol.* 5 : article 107.
- Lamichhane, G., Zignol, M., Blades, N.J., Geiman, D.E., Dougherty, A., Grosset, J., Broman, K.W and Bishai, W.R., 2003. A postgenomic method for predicting essential genes at subsaturation levels of mutagenesis: Application to *Mycobacterium tuberculosis*. *PNAS.* 100: 7213–7218
- Lattman, E. E and Rose, G. D., 1993. Protein folding, what's the question? *Proc. Natl Acad. Sci. USA.* 90: 439-441.
- Lazarevic, V dan Flynn, J.A., 2002. CD8⁺T Cells in Tuberculosis. *Am J Respir Crit Care Med.* 166 : 1116–1121.
- Lee, W.L., Gold, B., Darby, C., Brot, N., Jiang, X., de Carvalho, L.P., Wellner, D., St. John, G., Jacobs, W.R and Nathan, C., 2009. *Mycobacterium tuberculosis* expresses methionine sulphoxide reductases A and B that protect from killing by nitrite and hypochlorite. *Mol Microbiol.* 71: 583-93.
- Lemos, M.P., McKiney, J and Rhee, K.Y., 2011. Dispensability of Surfactant Proteins A and D in Immune Control of *Mycobacterium tuberculosis* Infection following Aerosol Challenge of Mice. *Infect Immun.* 79 : 1077 – 85.
- Lesk, A.M., 2001. Introduction to Protein Architecture: The Structural Biology of Proteins. Oxford University Press. Oxford.
- Levitskaya, J., M. Coram, V. Levitsky, S. Imreh, P. M. Steigerwald-Mullen, G. Klein, M. G. Kurilla, and M. G. Masucci. 1995. Inhibition of antigen processing by the internal repeat region of the *Epstein-Barr virus nuclear antigen-1*. *Nature* 375:685–688.

- Lindenmann, J., 1984. Origin of the Terms Antibody and Antigen. *J. Immunol.* 19: 281 – 5.
- Lisdawati, V., Parwati, I., Sudarmono, P., Sudiro, M., Ramadhany, R., Puspandari, N., Rifa'ati, L and Triyani, S., 2010. Studi Pemetaan Awal DNA *Mycobacterium tuberculosis* complex secara *spoligotyping* pada hasil isolasi dahak pasien tuberculosis paru dari 10 Ibu Kota Provinsi. *Bul. Penelit. Kesehat.* 38 : 169 – 85.
- Lodish, H., Berk, A., Matsudaira, P., Kaiser, C.A., Krieger, M., Scott, M.P., Zipurksy, S.L and Darnell, J., 2004. *Molecular Cell Biology* 5th ed. WH Freeman and Company. New York.
- Lubke, T., Lobel, P and Sleat, D., 2009. Proteomics of the Lysosome. *Biochim Biophys Acta.* 1793: 625–635.
- Malik, Z.A., Thompson, C.R., Hasmi, S., Porter, B., Iyer, S.S and Kusner, D.J., 2003. *Mycobacterium tuberculosis* blocks Ca²⁺ signaling and phagosome maturation in human macrophages via specific inhibition of sphingosine kinase. *J Immunol* 170: 2811–5
- Malhotra, V., Sharma, D., Ramanathan, V.D., Shakila, H., Saini, D.K., Chakravorty, S., Das, T.K., Li, Q., Silver, R.F., Narayanan, P.R and Tyagi, .S., 2004. Disruption of response regulator gene, *devR*, leads to attenuation in virulence of *Mycobacterium tuberculosis*. *FEMS Microbiol. Lett.* 231: 237–45.
- McBride, A., Bhatt, K and Salgame, P., 2011. Development of a secondary immune response to *Mycobacterium tuberculosis* is independent of Toll-like receptor 2. *Infection and Immunity.* 79 : 1118–23.
- McNeil, M., Wallner, S., Hunter, S.W and Brennan, P.J., 1987. Demonstration that the galactosyl and arabinosyl residues in the cell-wall arabinogalactan of *Mycobacterium leprae* and *Mycobacterium tuberculosis* are furanoid. *Carbohydr Res* 166: 299 – 308.
- McNeil, M., M. Daffe, and P. J. Brennan. 1990. Evidence for the nature of the link between the arabinogalactan and peptidoglycan of mycobacterial cell walls. *J. Biol. Chem.* 265:18200–18206.
- Menon, M.P.S., 1997. A New look at the immunology of tuberculosis. *Ind. J. Tub.* 44: 3 – 6.
- Miranda, M.S., Breiman, A., Allain, S., Deknuydt, F and Altare, F., 2012. The Tuberculous Granuloma: An Unsuccessful Host Defence Mechanism Providing a Safety Shelter for the Bacteria?. *Clinical and Developmental Immunology.* Article ID 139127 : 1-14.

- Mishra, K.C., Chastellier, C., Narayana, Y., Bifani, P., Brown, A.K., Besra, G.S., Katoch, V.M., Joshi, B., Balaji, K.N and Kremer, L., 2008. Functional Role of the PE Domain and Immunogenicity of the *Mycobacterium tuberculosis* Triacylglycerol Hydrolase LipY. *Infect Immun.* 76: 127 – 40.
- Muchtar, Y., Edison and Putra, A.E., 2011. Hubungan genotyping *M. tuberculosis* dengan manifestasi klinis. Laporan penelitian Iptekdok 2011.
- Murray, C.J.L., Ortblad, K.O., Guinovart, C., 2014 Global, regional, and national incidence and mortality for HIV, tuberculosis, and malaria during 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. *Lancet.* 384: 1005 – 70
- Noble, A., Truman, J.P., Vyas, B., Vukmanovic-Steejic, M., Hirst, W.J and Kemeny, D.M., 2000. The balance of protein kinase C and calcium signaling directs T cell subset development. *J Immunol* 164: 1807–13.
- National Committee for Clinical Laboratory Standards, 2000. Susceptibility testing of mycobacteria, nocardia, and other aerobic actinomycetes. Tentative Standard M24-T2, 2nd. ed. NCCLS.
- Noss, E.H., Pai, R.K., Sellati, T.J., Radolf, J.D., Belisle, J., Golenbock, D.T., Boom W,H and Harding, C.V., 2001. Toll-like receptor 2-dependent inhibition of macrophage class II MHC expression and antigen processing by 19-kDa lipoprotein of *Mycobacterium tuberculosis*,” *J immunol.* 167 : 910–8.
- Okkels, L.M., Brock, I., Follmann, F., Agger, E.M., Arend, S.M., Ottenhoff, T.H., Oftung, F., Rosenkrands, I., Andersen, P., 2003. PPE protein (Rv3873) from DNA segment RD1 of *Mycobacterium tuberculosis*: strong recognition of both specific T-cellepitopes and epitopes conserved within the PPE family. *Infect.Immun.* 71: 6116–23.
- Onuchic, J.N and Wolynes, P.G., 2004. Theory of protein folding. *Current Opinion in Structural Biology.* 14:70–75.
- Nelson, D.L and Cox, M.M., 2004. *Lehninger Principles of Biochemistry.* W.H. Freeman & Company. New York.
- Parwati, I., van Crevel, R., Sudiro, M., Alisjahbana, B., Pakasi, T., Kremer, K., van Zanden, A and van Soolingen, D., 2008. The population structure of *Mycobacterium tuberculosis* differs significantly on two Indonesian Islands. *J Clin Microbiol.* 46: 3639 – 42.
- Parwati, I., Alisjahbana, B., Apriani, L., Soetikno, R.D., Ottenhoff, T.H., van der Zanden, A.G.M et al., 2010. *Mycobacterium tuberculosis* Beijing Genotype Is an Independent Risk Factor for Tuberculosis Treatment Failure in Indonesia. *The J infect Dis.* 201: 553 – 7.
- Perez, E., Samper, S., Bordas, Y., Guilhot, C., Gicquel, B and Martin, C., 2001. An essential role for *phoP* in *Mycobacterium tuberculosis* virulence. *Mol. Microbiol.* 41:179–87.

- Poulet, S and Cole, S.T., 1995. Characterization of the highly abundant *polymorphic GC Rich Repetitive sequence* (PGRS) present in *Mycobacterium tuberculosis*. *Arch Microbiol.* 163: 87-95.
- Putra, A.E., Zailirin, Khairisyaf, O., 2011. Potensi Interferon Gamma Releasing Assay (IGRA) sebagai marker diagnostik TB laten. Naskah publikasi PIT PAMKI. Makassar.
- Ramakrishnan, L., Federspiel, N., Falkow, S., 2000. Granuloma-specific expression of *Mycobacterium* virulence proteins from the glycine-rich PE-PGRS family. *Science.* 2888 : 1436–9
- Raja, A., 2004. Immunology of *Tuberculosis*. *Indian J Med Res.* 120 : 213-32
- Reece, S.T and Kauffman, S.H.E., 2012. Floating between the poles of pathology and protection: can we pin down the granuloma in tuberculosis?. *Current Opinion in Microbiology.* 15: 63–70.
- Rothfield, L., Taghbalout, A., and Shih, Y.L., 2005. Spatial control of bacterial division-site placement. *Nat Rev Microbiol* 3: 959–968; Gueiros-Filho, F.J., and Losick, R., 2002. A widely conserved bacterial cell division protein that promotes assembly of the tubulin-like protein FtsZ. *Genes Dev.* 16: 2544 – 56.
- Rodriguez, G.M., Voskuil, M.I., Gold, B., Schoolnik, G.K and Smith, I., 2002., *ideR*, An essential gene in *Mycobacterium tuberculosis*: role of IdeR in irondependent gene expression, iron metabolism, and oxidative stress response. *Infect Immun* 70: 3371-81.
- Salminen, A and Hulkkonen, J., 2005. DNA, RNA and Protein Structure Prediction. *Basics for Biosystems of the Cell.* 112:1 -11.
- Sasseti, C.M and Rubin, E.J., 2003. Genetic requirements for mycobacterial survival during infection. *Proc Natl Acad Sci.* 100: 12989 – 94.
- Saviola, B., 2010. All Stressed Out: Mycobacterial Responses to Stress. *Current Research, Biotechnology and Education topics in applied microbiology and microbial biotechnology.* 545 – 9.
- Shin, D.M., Jeon, B.Y., Lee, H.M., in, H.S., Yuk, .M., Song, C.H., Lee, S.H., Lee, Z.W., Cho, S.N., Kim, J.M., Friedman, R.L and Jo, E.K., 2010. *Mycobacterium tuberculosis* eis regulates autophagy, inflammation, and cell death through redox-dependent signaling. *PLoS Pathogens.* 6: e1001230.
- Sendide, K., Deghmane, A-E., Reytrat, J-M., Talal, A and Hmam, Z., 2004. *Mycobacterium bovis* BCG Urease Attenuates Major Histocompatibility Complex Class II Trafficking to the Macrophage Cell Surface. *Infect. Immun.* 72: 4200-9
- Singh, K.K., Zhang, X., Patibandla, A.S., Chien Jr, P and Laal, S., 2001. Antigens of *Mycobacterium tuberculosis* Expressed during Preclinical Tuberculosis:

- Serological Immunodominance of Proteins with Repetitive Amino Acid Sequences. *Infect Immun.* 69 : 4185–91.
- Smith, I., 2003. *Mycobacterium tuberculosis* ; Pathogenesis and molecular determinants of virulence. *Clin Microbiol Rev.* 16 : 463 – 96.
- Sreevatsan, S., Pan, X., Stockbauer, K.E., Connell, N.D., Kreiswirth, B.N., Whittam, T.S and Musser, J.M., 1997. Restricted structural gene polymorphism in the *Mycobacterium tuberculosis* complex indicates evolutionarily recent global dissemination. *Proc Natl Acad Sci.* 94: 986-74.
- Srilohasin, P., Chaiprasert, A., Tokunaga, K., Nishida, N., Prammananan, T., Smittipat, N., Mahasirimongkol, S., Chaiyasirinroje, B., Yanai, H and Palittapongarnpim, P., 2014. Genetic Diversity and Dynamic Distribution of *Mycobacterium tuberculosis* Isolates Causing Pulmonary and Extrapulmonary Tuberculosis in Thailand. *J Clin Microbiol.* 52: 4267 – 74.
- Stead, W.W., Eisenach, K.D., Cave, M.D., Beggs, M.L., Templeton, G.L., Thoen, O.C., Bates, J.H., 1995. When did *Mycobacterium tuberculosis* infection first occur in the New World? An important question with public health implications. *Am. J. Respir. Crit. Care Med.* 151: 1267-8.
- van Soolingen, D., de Haas, P.E., Hermans, P.W., Groenen, P.M and van Embden, J.D., 1993. Comparison of various repetitive DNA elements as genetic markers for strain differentiation and epidemiology of *Mycobacterium tuberculosis*. *J. Clin. Microbiol.* 31, 1987–1995.
- van Soolingen, D., Qian, L., de Haas, P.E., Douglas, J.T, Traore, H, et al., 1995 Predominance of a single genotype of *Mycobacterium tuberculosis* in countries of east Asia. *J Clin Microbiol* 33: 3234 - 8
- Sugawara, I., Yamada, H., Li, C., Mizuno, S., Takeuchi, O and Akira, S., 2003. *Mycobacterial* infection in TLR2 and TLR6 knockout mice. *Microbiology and Immunology.* 47: 327–36.
- Talarico, S., Cave, M.D., Marrs, C.F et al., 2005. Variation of the *Mycobacterium tuberculosis* PE-PGRS33 Gene among Clinical Isolates. *J Clin Microbiol.* 43:4954 – 60.
- Talarico, S., Zhanga, L., Marrsa, C.F et al., 2008. *Mycobacterium tuberculosis* PE_PGRS16 and PE_PGRS26 Genetic Polymorphism among Clinical Isolates. *Tuberculosis (Edinb).* 88 : 283 - 294.
- Thakur, M., and P. K. Chakraborti., 2006. GTPase activity of mycobacterial FtsZ is impaired due to its transphosphorylation by the eukaryotic-type Ser/Thr kinase, PknA. *J. Biol. Chem.* 281 : 40107–13.
- Thornton, J.M., Orengo, C.A., Todd, A.E and Pear, F.M.G., 1999. Protein Folds, Functions and Evolution. *J. Mol. Biol.* 293: 333-342.

- Thomas, P. J., Qu, B and Hedersen, P. L., 1995. Defective protein folding as a basis of human disease. *Trends Biochem. Sci.* 20: 456-459.
- Vergne, I., Chua, J and Deretic, V., 2003. Tuberculosis toxin blocking phagosome maturation inhibits a novel Ca^{2+} /calmodulin-PI3K hVPS34 cascade. *J Exp Med.* 198: 653–659.
- Vergne, I., Fratti, R.A., Hill, P.J., Chua, J., Belisle, J and Deretic, V., 2004. *Mycobacterium tuberculosis* phagosome maturation arrest: mycobacterial phosphatidylinositol analog phosphatidylinositol mannoside stimulates early endosomal fusion. *Molecular Biology of the Cell.* 15 : 751–6.
- Voskuil, M.I., Visconti, K.C and Schoolnik, G.K., 2004., *Mycobacterium tuberculosis* gene expression during adaptation to stationary phase and lowoxygen dormancy. *Tuberculosis (Edinb)* 84: 218-27.
- WHO., 2014. Global Tuberculosis Control; Surveillance, Planning, Financing. WHO. Geneva.
- Wirth, T., Wirth, T., Hildebrand, F., Allix-Be'guec, C., Wolbeling, F., Kubica, T., Kremer, K., van Soolingen, D., Rusch-Gerdes, S., Locht, C., Brisse, S., Meyer, A., Supply, P and Niemann, S., 2008. Origin, Spread and Demography of the *Mycobacterium tuberculosis* Complex. *PLoS Pathogens* . 4 : e1000160
- Williams, S.G and Lovell, S.C., The Effect of Sequence Evolution on Protein Structural Divergence. *Mol. Biol. Evol.* 26: 1055–1065.
- Ye, Y and Rape, M., 2009. Building ubiquitin chains: E2 enzymes at work. *Nat Rev Mol Cell Biol.* 10: 755–764.
- Yuwono, T., 2005. Biologi Molekuler. Erlangga. Jakarta.
- Yuen, C.M., Weyenga, H.O., Kim, A.A 2014. Comparison of Trends in Tuberculosis Incidence among Adults Living with HIV and Adults without HIV – Kenya 1998–2012. *Plos One.* 9 : e99880.
- Zuniga, J., Torres-Garcia, D., Santos-Mendoza, T., Rodriguez-Reyna, T., Granados, J and Yunis, E., 2012. Cellular and Humoral Mechanisms Involved in the Control of Tuberculosis. *Clinical and Developmental Immunology.* Article ID 193923: 1 – 18.

UCAPAN TERIMA KASIH

1. Libtanges – Kemenkes RI melalui skim pendanaan IPTEKDOK tahun 2012 terkait penelitian analisis *Genotyping M. tuberculosis* di Sumatera Barat
2. Kemenristek RI, Melalui skim penelitian Riset Insentif tahun 2012 terkait penelitian pengembangan protein PE-PGRS sebagai kandidat vaksin *M. tuberculosis*
3. Dirjen Dikti – Kemendiknas, melalui skim pendanaan Hibah bersaing tahun 2014 terkait penelitian desain pepetida sintetik PE-PGRS sebagai kandidat diagnosis cepat *M. tuberculosis*