

References

- Allen, B.W., Mitchison, D.A., Dargyshire, J., Chew, W.W., and Gabriel, M. Examination of operation specimens from patients with spinal tuberculosis for tubercle bacilli. *J.Clin. Pathol.* 36,6 (1983):662-666.
- Anargyros, P., Astill-David, S.J., and Lim-Irene, S.L. Comparison of improved BACTEC and Lowenstein-Jensen media for culture of mycobacteria from clinical specimens. *J.Clin.Microbiol.* 28 (1990): 1288-1291.
- Arloing, S, and Courmont, P. Serum diagnosis of tuberculosis. *Bost. Med.and Surg.J.* 151 (1904) :617-623.
- Ashtekar, M.D., Dhalla, A.S., Mazarello, T.B., and Samuel, A.M. A study of *Mycobacterium tuberculosis* antigen and antibody in cerebrospinal fluid and blood in tuberculous meningitis. *Clin.Immunol. Immunopathol.* 45 (1987) : 29-34.
- Banchuin, N.,Pumprueg, U., Pimolpan, V., Sarasombath, S.,and Danpukdee, K. Anti-PPD IgG responses in tuberculosis pleurisy. *J. Med. Ass. Thai.* 70 (1987) : 321-325.
- Beaman, B.L., and Burnside, J. Pyridine extraction of nocardia acid fastness. *Appl. Microbiol.* 26 (1973) :426-428.
- Benjamin, R.G., Debanne, S.M., Ma, Y.,and Daniel, T.M. Evaluation of mycobacterial antigens in an enzyme-linked immunosorbent assay (ELISA) for the serodiagnosis of tuberculosis. *J. Med. Microbiol.* 18 (1984) : 309-318.
- Berg, J.W. An acid-fast lipid from spermatozoa. *Arch. Pathol.* 57 (1954): 115-120.

- Bhardwaj, O.P., Srivastava, V.K., and Balakrishnan, K. Soluble antigen fluorescent antibody (SAFA) test in serodiagnosis of disseminated and extra-pulmonary tuberculosis. *Indian J. Med. Res.* 73 (1981): 150-156.
- Bhattacharya, A., Ranadive, S.N., Kale, M., and Bhattacharya, S. Antybody based enzyme-linked immunosorbent assay for determination of immune complexes in clinical tuberculosis. *Am.Rev.Respir.Dis.* 135 (1986):205-209.
- Boyd, J.C., and Marr, J.J. Decreasing reliability of acid-fast smear techniques for the detection of tuberculosis. *Ann. Intern.Med.* 82 (1975) : 489-492.
- Boyden, S.V. The adsorption of proteins on erythrocytes treated with tannic acid and subsequent hemagglutination by antiprotein sera. *J.Exp.med.* 93 (1951) : 107-120.
- Brostoff, J., Lenzini, L., Rottoli, P., and Rottoli, L. Immune complexes in the spectrum of tuberculosis. *Tubercle* 62 (1981):169-173.
- Brundelt, P.J. Acid-fast staining of hooklets of *Taenia echinococcus*. *Lancet* 1 (1973): 678-680.
- Buchanan, R.E., and Gibbons, N.E., eds. *Bergey's manual of determinative bacteriology*. 8th ed. Baltimore: Williams & Wilkins, 1984 .
- Burdash, N.M., Manos, J.P., Ross, D., and Bannister, E.R. Evaluation of the acid-fast smear. *J.Clin.Microbiol.* 4 (1976) : 190-191.
- Burrell, R.G., Rheins, N.M., and Birkeland, J.M., Tuberculosis antibodies demonstrated by agar diffusion. It Further characterization of these antibodies and their distribution in human tuberculous. *Am.Rev. Tuberc.* 74 (1956) :239-244.
- Caphin, M., ed. *The tuberculin test in clinical practice*. London : Bailliire Tindall, 1980.

- Chaparas, S.D., Brown, T.M., and Hyman, I.S. Antigenic relationships of various *Mycobacteria* species with *Mycobacterium tuberculosis*. *Am.Rev. Resp.Dis.* 117 (1978) :1091-1095.
- _____, and Maloney, C.I. An analysis of cross reactions among mycobacteria by *in vivo* and *in vitro* assays of cellular hypersensitivity. *Am.Rev.Resp.Dis.* 117 (1978) :897-901.
- Chawla, T.C., Sharma, A., Kiran, U., Bhargava, D.K., and Tandon, B.N. Serodiagnosis of intestinal tuberculosis by enzyme immunoassay and soluble antigen fluorescent antibody tests using a saline extracted antigen. *Tubercle* 67 (1986): 55-60.
- Cole, L.R., and Farrell, V.R. A method for coupling protein antigens to erythrocytes. I. Description of method. *J.Exp. Med.* 102 (1955) : 631-645.
- _____, Matloff, J.J., and Farrell, V.R. A method for coupling protein antigens to erythrocytes. II. Use of the method in diagnosis of tuberculosis. *J.Exp.Med.* 102 (1955): 647-653.
- Collins, C.H., Grange, J.M., and Yates, M.D., eds. Organization and practice in tuberculosis bacteriology. London : Butterworths, 1985.
- Comstock, G.W. False tuberculin test result. *Chest* 68 (suppl) (1975): 465-466.
- Daniel, T.M. Antibody and antigen detection for the immunodiagnosis of tuberculosis : Why not ? What more is needed ? Where do we stand today ? *J. Infect. Dis.* 158 (1988) : 678-680.

- _____, Debanne, S.M., and Van der Kuyp, F. Enzyme-linked immunosorbent assay using *Mycobacterium tuberculosis* antigen 5 and PPD for the serodiagnosis of tuberculosis. *Chest* 88 (1985) : 88-392.
- _____, Rapid diagnosis of tuberculosis : laboratory technique applicable in developing countries. *Rev. Infect. Dis.* 11 suppl 2 (1989) : 471-478.
- Dannenberg, A.M. Pathogenesis of pulmonary tuberculosis. *Am. Rev. Resp. Dis.* 152 (1982) : 25-29.
- Daramas, S., Konjanart, S., and Sunakorn, B. Second tuberculosis base-line survey in Thailand. *Thai J. Tuberc. Chest Dis.* 1 (1980) : 179-191.
- Davis, B.D., Dulbecco, R., Eisen, H.N., and Ginsberg, H.S., eds. *Microbiology* 3rd ed. Philadelphia : Harper & Row, 1980.
- Dhand, R., Ganguly, N.K., Vaishnavi, C., Gilhotra, R., and Malik, S.K. False-positive reaction with enzyme-linked immunosorbent assay of *Mycobacterium tuberculosis* antigens in pleural fluid. *J. Med. Microbiol.* 26 (1988) : 241-243.
- _____, Serology of tuberculosis. *Indian J. Chest. Dis & All Sci.* 28 (1986) : 135-154.
- Division of epidemiology, Ministry of public health, Bangkok, Thailand. Weekly epidemiological surveillance report. 22 (1991) : 503-518.
- Edwards, D., and Kirkpatrick, C.H. The immunology of mycobacterial disease. *Am. Rev. Respir. Dis.* 134 (1986) : 1062-1071.
- Ellner, P.D., Kiehn, T.E., Cammarata, R., and Hosmer, M. Rapid detection and identification of pathogenic mycobacteria by combining radiometric and nucleic acid probe methods. *J. Clin. Microbiol.* 26 (1988) : 1349-1352.
- Falkner, M.J., Reeve, P.A., and Locket, S. The Diagnosis of Tuberculous ascites in a rural african community. *Tubercle* 66 (1985) : 55-59.

- Fine, P.E.M. The BCG story : lessons from the past and implications for the future. *Rev.Infect.Dis. suppl.2* (1989): 353-359.
- Glenchur, H.,and Kettel, L.J. A study of the agar double-diffusion test in human tuberculosis. *Am.Rev.Resp.Dis.* 91 (1965) : 86-96.
- Gordin, F.M., Slútkin, G., Schecter, G., Goodman, P.C.,and Hopewell, P.C.Presumptive diagnosis and treatment of pulmonary tuberculosis based on radiographic findings. *Am. Rev. Respir. Dis.* 139 (1989) :1090-1093.
- Goren, M.B. Mycobacterial lipids. *Bacteriol.Rev.* 36 (1972) : 33-64.
- Grange, J.M., Gibson, J., Nassau, E.,and Kardjito, T. ELISA : A study of antibodies to *Mycobacterium tuberculosis* in the IgG, IgA and IgM classes in tuberculosis, sarcoidosis and Crohn's disease. *Tubercle* 61 (1980):145-152.
- _____, and Kardjio, T. Serological test for tuberculosis : can the problem of low specificity be overcome ? *Indian. J. Chest. Dis.* 24 (1982) : 108-117.
- _____. The Humoral Immune Response in Tuberculosis. *Adv. Tuberc. Res.* 21(1984): 1-78.
- Grosset, J.H. Present status of Chemotherapy for tuberculosis. *Rev.Infect.Dis.* 11 suppl. 2 (1989) :347-352.
- Holden ,M., Dubin ,M.R., and Diamond ,P.H. Frequency of negative intermediate-strength tuberculin sensitivity in patients with active tuberculosis. *New Engl.J.Med.* 285 (1971) : 1506.
- Hermans-Peter ,W.M., Schuitema-Anja ,R.J., and soelingen , D.V. Specific detection of *Mycobacterium tuberculosis* complexes strains by polymerase chain reaction. *J. Clin. Microbiol.* 28 (1990) : 1204-1213.

- Immunological research in tuberculosis : Memorandum from a WHO meeting. *Bull. WHO* 60 (1982) :723-727.
- Jagannath ,C., and Sengupta ,D.N. Serology of tuberculosis. It Measurement of antibodies to *M.tuberculosis* by a passive hemagglutination test in human tuberculosis. *Tubercle* 64 (1983) : 201-210.
- Jaquess, P.A., Smalley,D.L., and Duckworth,J.K. Enhanced growth of *Mycobacterium tuberculosis* in the presence of selenium. *Am.J.Clin. Pathol.* 72 (1981):209-210.
- Joklik , W.K., Willett, H.P.,and Amos, D.B.eds. *Zinsser Microbiology*. 17th ed. New York : Appleton-century-crofts , 1980.
- Kadival, G.V., Mazarelo, T.B., and Chaparas, S.D. Sensitivity and specificity of enzyme-linked immunosorbent assay in the detection of antigen in tuberculosis meningitis cerebrospinal fluids. *J. Clin. Microbiol.* 23 (1986) : 901-904.
- _____, Samuel , A.M., Viridi, B.S., Kale, R.N.,and Gantara, R.D. Radioimmunoassay of tuberculous antigen . *Indian J. Med. Res.* 75 (1982): 765-770.
- Kaplan ,M.H., and Chase ,M.W. Antibodies to mycobacteria in human tuberculosis. I. Development of antibodies before and after antimicrobial therapy. *J.Infect.Dis.* 142(1980) : 825-834.
- Karney, W.W.,O' Donoghue, J.M., Ostrow, J.H., Holmes, K.K., and Beauty, H.N. The spectrum of tuberculosis peritonitis. *Chest* 72 (1977): 310.
- Khan, M.A., Karvant, D.M., Bachus, B. et al. Clinical and radiographic spectrum of pulmonary tuberculosis in the adult. *AM. J. Med.* 62 (1977) :31-35.
- Kochi,A. The global tuberculosis situation and the new control strategy of the World Health Organization. *Tubercle* 72 (1991) : 1-6.

- Konjanart, S. Tuberculosis epidemiology. Handout from tuberculosis division, Department of communicable disease control, Ministry of public health, Bangkok, Thailand., 1987.
- Kononov, Y., Ta, K.D. and Heifets, L. Effect of egg yolk on growth of *Mycobacterium tuberculosis* in 7H12 liquid medium. *J.Clin.Microbiol.* 26,7 (1988):1395-1397.
- Krasnow, I., and Wayne, L.G. Comparison of methods for tuberculosis bacteriology. *Appl. Microbiol.* 18 (1969):815-917.
- Kubica, G.P., and Wayne, L.G., ed. *The mycobacteria, a sourcebook part A and B.* New York : Marcel Dekker Inc., 1984.
- Langer, S.S. Initial evaluation of pulmonary tuberculosis. *Illinois Med.J.* 167 (1985) : 56-57.
- Leelarasamee, A., and Bavornkitti, S. Immunodiagnosis of tuberculosis : a review. *APJAI* 7 (1989) : 57-61.
- Lennette, E.H., Balows, A., Hausler, W.J., and Jean Shadomy, H. *Manual of clinical microbiology* 4th ed. Washington, D.C.: American Society for Microbiology, 1985.
- Lipsky, B.A., Gates, J., Tenover, F.C., and Plorde, J.J. Factors affecting the clinical value of microscopy for acid-fast. *Rev.Infect.Dis.* 6 (1984) : 214-222.
- Lyon, R.H., Hall, W.H., and Costas-Martinez, C. Effect of L-Asparagine on growth of *Mycobacterium tuberculosis* and on utilization of other amino acids. *J.Bacteriol.* 117,1 (1974):151-156.
- Maillard, E.R., and Gagliardo, F.J. A new test for tuberculosis. *Am.Rev.Respir.Dis.* 64 (1951) : 675-681.
- Matajack, M.L., Bissett, M.L., Schifferle, D., and Wood, R.M. Evaluation of a selective medium for mycobacteria. *Am. J. Clin. Pathol.* 59 (1973):391-397.

- McClatchy, J.K., Waggoner, R.F., Kanes, W., Cernick, M.S., and Bolton, T.L. Isolation of mycobacteria from clinical specimens by use of selective 7H11 medium. *Am.J. Clin.Pathol.* 65 (1976): 412-416.
- Martin, T., Cheke, D.L., and Matyshak, I. Broth culture : The modern "guinea-pig" for isolation of mycobacteria. *Tubercle* 70 (1989): 53-56.
- May, J.J., Katilus, J., Henson, P.M., and Dreisin, R.B. The purification and identification of circulating immune complexes in tuberculosis. *Am.Rev.Respir.Dis.* 128 (1983) : 920-925.
- Middlebrook, G. A hemolytic modification of the hemagglutination test for antibodies against tubercle bacillus antigens. *J.Clin.Invest.* 29 (1950) : 1480-1485.
- Mitchison, D.A, Aber, V.R., Ahmad, F.S., Allen, B.W., and Devi, S. Evaluation of a serological test for tuberculosis. *Br.Med.J.* 1 (1977) : 1383-1384.
- Mitchison, D.A., and Aber, V.R. Culture of specimens other than sputum for mycobacteria, *J.Clin.Pathol.* 27 (1974): 883-887.
- Mitchison, D.A., Allen, B.W., and Lambert, R.A. Selective media in the isolation of tubercle bacilli from tissue. *J.Clin.Pathol.* 26 (1973): 250-252.
- Mitchison, D.A., Allen, B.W., and Manickavasagar, D. Selective Kirchner medium in the culture of specimens other than sputum for mycobacteria. *J.Clin.Pathol.* 36,12 (1983): 1357-1361.
- Morris, C.A., and Barton, B.W. Is guinea-pig inoculation ever justified for the diagnosis of tuberculosis? *J.Clin.Pathol.* 36 (1983): 719-720.

- Nassau, E., and Merrick, A.J. The fluorescent antibody test in human tuberculosis a pilot study. *Tubercle* 51 (1970) : 430-436.
- _____. Parsons, E.R., and Johnson ,G.D. Detection of antibodies to *Mycobacterium tuberculosis* by solid phase radio-immunoassay. *J. Immunol. Methods.* 6 (1975) : 261-271.
- _____. Parsons ,E.R., and Johnson ,G.D., The detection of antibodies to *Mycobacterium tuberculosis* by microplate enzyme-linked immunosorbent assay (ELISA). *Tubercle* 57 (1976) : 67-70.
- Nuchprayoon ,C., and Hongprapas ,W. The use of bovine serum as an enrichment in 7H10 agar medium. *Thai J.Tuberc. Chest Dis.* 1 (1980): 27-35.
- Pao, C.C., Lin ,S.S., Wu ,S.Y., Juang, W.M., Chang ,C.H. and Lin, J.Y. The detection of mycobacterial DNA sequences in uncultured clinical specimens with cloned *Mycobacterium tuberculosis* DNA as probes. *Tubercle* 69 (1988) : 27-36.
- Park, C.H., Hixon ,D.L., and Ferguson ,C.B. Rapid recovery of mycobacteria from clinical specimens using automated radiometric technic. *Am.J.Clin.Pathol.* 81 (1984) : 341-345.
- Parlett, R.C., Youman, G.P., Rehr, C., and Lester ,W. The detection of antibodies in the serum of tuberculous patients by an agar double-diffusion precipitation technique. *Am. Rev. Tuberc.* 77 (1958) : 462-472.
- Patel, R.J., Fries-Jochen, W.U., Piessens, W.F., and Wirth, D.F. Sequence analysis and amplification by polymerase chain reaction of a cloned DNA fregment for identification of *Mycobacterium tuberculosis*. *J.Clin.Microbiol.* 28 (1990) : 513-518.

- Pawlowski, Z., and Schultz, M.G. Taeniasis and cysticercosis (*Taenia saginata*). *Adv. Parasitol.* 10 (1972) : 269-343.
- Pepys, J. The relationship of nonspecific and specific factors in a tuberculin reaction. *Am.Rev.Tuberc.* 71 (1955): 49-61.
- Pollock, H.K., and Wieman, E.J. Smear result in the diagnosis of mycobacteriosis using blue light fluorescence microscopy. Public Health Ministry, *J. Clin. Microbiol.* 5 (1977) : 329-331.
- Pumprueg, U., Kanpai, M., Kumnuankun, M., Tuppavattana, S., Pornchaipooltavee, S., and Sudsamart, C. A comparison of Ogawa and Gudohs P.D. media. *Thai J. Tuberc. Chest Dis.* 11 (1990): 193-201.
- Ramkisson, A., Coovadia, Y.M., and Coovadia, H.M. A competition ELISA for the detection of mycobacterial antigen in tuberculous exudates. *Tubercle* 69 (1988) : 209-212.
- Ratlidge, C. The physiology of mycobacteria. *Adv.Microb.Physiol.* 13 (1976) : 115.
- Reggiardo, Z., Vazgues, E., and Schnaper, L. ELISA tests for antibodies against mycobacterial glycolipids. *J. Immunol. methods.* 34 (1980) : 55-60.
- Reichman, L.B. Tuberculosis screening and chest X-ray films. *Chest* 68 (1975) : 448-451.
- Reiger, M., Trnka, L., Skvor, J., and Mison, P. Immunoprofiles studies in patients with pulmonary tuberculosis. *Scand.J. Respir.Dis.* 60 (1979) : 172-175.
- Reynolds, J.E.F. *Martindale* 29 th ed. London : The Pharmaceutical Press, 1989.
- Robson, J.M., and Sullivan, F.M. Quantitative studies on the multiplication of tubercle bacilli in vivo. *Am.Rev.Tuberc.* 75 (1957) : 756-767.

Rosenthal, S.R., ed. BCG vaccine. In : **Tuberculosis-cancer.**

Massachusetts : PSG publishing Co. Inc. Letteton 1983.

Samuel, A.M., Ashtekar, M.D. and Gantara, R.D. Significance of circulating immune complexes in pulmonary tuberculosis. **Clin. Exp. Immunol.** 58 (1984) : 317-324.

_____, Kadival, G.V., Irani, S., Pandya, S.K., and Gantara, R.D. A sensitive and specific method for diagnosis of tuberculous meningitis. **Indian J. Med. Res.** 77 (1983) : 752-757.

Schaefer, W.B., Cohn, M.L., and Middlebrook G. The roles of biotin and carbon dioxide in the cultivation of *Mycobacterium tuberculosis*. **J. Bacteriol.** 69 (1955): 706-712.

_____, Marshak, A., and Burkhart, B. The growth of *Mycobacterium tuberculosis* as a function of its nutrients. **J. bacteriol** 58 (1949): 549-563.

Schlossberg, D. Tuberculosis. **Praeger Monographs in infectious disease.** Volume 2. Praeger scientific 1983.

Schubert, J.H., and Braser, C.A., An appraisal of serologic tests for tuberculosis using agar gel and complement-fixation procedure. **Am. Rev. Respir. Dis.** (96) 1967 : 745-750.

_____, and Dobos, R.J. Specific serum agglutination of erythrocytes sensitized with extracts of tubercle bacilli. **J. Exp. Med.** 88 (1948) : 521-528.

Shankar, P., Manjunath, N., Mohan, K.K., Prasad, K., Behari, M., Shrinivas and Ahuja, G.K. Rapid diagnosis of tuberculosis meningitis by polymerase chain reaction. **Lancet** 337 (1991): 5-7.

Sherris, J.C., ed. **Medical microbiology.** New York: Elsevier Science Publishing Co., Inc., 1984.

- Shoemaker, S.A., Fisher, J.H., and Scoggin, C.H. Techniques of DNA hybridization detect small numbers of mycobacteria with no cross-hybridization with nonmycobacterial respiratory organisms. *Am.Rev.Respir.Dis.* 131 (1985): 760-763.
- Smith, D.W., ed. *Medical microbiology and infectious disease*. Philadelphia : W.B. Saunder Co., 1981.
- Spector, W.G., and Heesom, N. The production of granulomata by antigen-antibody complex. *J.Pathol.* (98) 1969 :31-39.
- Stauffer, L.R., Hauff, C.M., and Sandstrom, R.E. Evaluation of the effect of sodium selenate on the growth of mycobacterial stock cultures. *Am.J.Clin.Pathol.* 78 (1982): 520-523.
- Stroebel, A.B., Daniel, T.M., Law, J.H., et al. Serologic diagnosis of bone and joint tuberculosis by an enzyme-linked immunosorbent assay. *J. Infect. Dis.* 146 (1982) : 280-283.
- Sula, L., Stott, H., Kubin, M. and Kiser, J. A study of mycobacteria isolated from cervical lymph gland of African patient Kenya. *Bull.Wld.Hlth.Org.* 23(1960) : 613-634.
- _____, Sundaresan, T.K. and Langerova, M. Effect of storage and transport on the cultivability of mycobacteria. *Bull. Wld.Hlth.Org.* 23(1960):635-651.
- Sunakorn, B. Tuberculosis epidemiology in Thailand. *J. Med. Assoc. Thailand* . 52 (1969) :157-162.
- Tandon, A., Saxena, R.P., Saxena, K.C., Jamil, Z., and Gupta, A.K. Diagnostic potentialities of enzyme-link immunosorbent assay in tuberculosis using purified tuberculin antigen. *Tubercle* 61 (1980) : 87-89.
- Ten Dam, H.G. Research on BCG vaccination. *Adv. Tuberc. Res.* 21 (1984) : 79-106.
- Toman, K. *Tuberculosis case-finding and chemotherapy*. Geneva : World Health Organization, 1979.

- Toussaint ,A.J., Fife ,E.H., Parlett ,R.C., Affronti ,L.F.,
Wright, G.L., Reich, M., and Morse, W.C. A soluble antigen
fluorescent antibody test for the serodiagnosis of
Mycobacterium tuberculosis infection. *Am.J.Clin.Path.* 52
(1969) : 708-713.
- Trakulsomboon, S. The Application of enzyme-linked immunosorbent
assay in detection of anti-PPD antibody in serum and
of mycobacterial antigen in sputum of pulmonary
tuberculosis patients. Master's Thesis, Mahidol University,
1986.
- Turcotte, D.R., Freedman, S.O., and Schon, A.H. A new hemaggluti-
nation procedure for the diagnosis of active tuberculosis.
Am.Rev.Respir.Dis. 8 (1963) : 725-728.
- _____, Freedman, S.O., and Sault ,F. Circulating IgG (7S)
hemagglutinins in pulmonary tuberculosis. *Am.Rev.Respir.*
Dis. 94 (1966) : 896-904.
- Vasanthakumari ,R. A single step culture technique for tubercle
bacilli. *Tubercle* 71 (1990) : 267-270.
- Vilijanen, M.K., Eskola, J., and Tala, E. ELISA for antibodies to
purified protein derivative of tuberculin (PPD) : IgM, IgA,
and IgG anti-PPD antibodies in active pulmonary tuberculosis.
Eur J Respir Dis. 63 (1982) : 257-262.
- Watt, G., Zaraspe ,G., Bautista ,S., and Laughlin ,L.W. Rapid
diagnosis of tuberculosis meningitis by using an enzyme-
linked immunosorbent assay to detect mycobacterial antigen
and antibody in cerebrospinal fluid. *J. Infect. Dis.* 158
(1988): 681-686.
- Wayne, L.G. Dynamics of submerged growth of *M.tuberculosis* under
aerobic and microaerophilic conditions. *Am.Rev.Resp.Dis.*
114 (1976): 807-811.

- Wanc, L.G. Microbiology of tubercle bacilli. *Am. Rev. Respir. Dis.* (Koch centennial suppl.) 125 (1982) : 31-41.
- Wehrle ,P.F., and Top ,F.H., eds. *Communicable and infectious diseases*. 9 th ed . : The C.V. Mosby Co, 1981.
- Wilkins, E.G. Tuberculous peritonitis : diagnostic value of the ascitic / blood glucose ratio. *Tubercle* 65 (1984): 47-52.
- Williams, S.J., Green ,M., and Nicholls ,A.C. An evaluation of the tuberculosis agglutination test. *Br. J. Dis. Chest.* 72 (1978) : 138-142.
- Wongwajana, S. *Assessment of immunological tests for diagnosis of Mycobacterium tuberculosis infection*. Master's Thesis, Mahidol University, 1990.
- Yanez, M.A., Coppola, M.P., Russo, D.A. Delsha, E., Chaparas, S.D., and Yeager ,H. Jr. Determination of mycobacterial antigen in sputum by enzyme immunoassay. *J. Clin. Microbiol.* 23 (1986) : 822-825.
- Youmans, G.P. *Tuberculosis*. Philadelphia : W.B. Saunders, 1979.

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Appendix

Reagent for acid-fast staining

1. Ziehl - Neelsen stain

a. Carbol - fuchsin

Basic fuchsin	3.0 g
Ethanol, 95 %	10.0 ml
Phenol solution 5% in carbolic acid	90.0 ml

Dissolve the basic fuchsin in the ethanol, mix the basic fuchsin solution with phenol solution. Let stand for several days and filter before use.

b. 3% Acid alcohol

HCl (concentrated)	3 ml
Ethanol, 95%	97 ml

c. Methylene blue counterstain

Methylene blue chloride	0.3 g
Distilled water	100.0 ml

2. Kinyoun stain

The formula is similar to Ziehl-Neelsen except concentration of basic fuchsin which is ten fold of basic fuchsin in Ziehl-Neelsen stain.

Staining procedures

1. Ziehl - Neelsen staining procedure

- a. Cover the heat-fixed film with strong carbol fuchsin.
- b. Heat the stain-covered slide with a flame to steaming but do not allow to dry, and kept it steaming for 5 minutes, replenished the stain if necessary.
- c. Wash with water, and allow to drain.

- d. Decolorize with 3% acid-alcohol until no more stain appears.
- e. Wash with water, and allow to drain
- f. Counterstain with methylene blue for 1 to 2 mins.
- g. Wash with water, and air dry.
- h. Examine with 100% oil immersion objective over the entire smear.

Mycobacteria are stained red and the background light blue.

2. Kinyoun staining procedure (cold method)

The procedure is similar to the former method but there is no heat in step b. So, strong carbol fuchsin is used for 5 minutes and then is followed as step c to h.

Culture media

1. Lowenstein - Jensen media

KH_2PO_4 anhydrous	2.40	g
$\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$	0.24	g
MgCO_3	0.60	g
Asparagine	3.60	g
Potato flour	30.00	g
Glycerol	12.00	ml
Distilled water	600.00	ml
Homogenized whole eggs	1,000	ml
Malachite green 2%	200.00	ml

- a. Dissolve the salts and asparagine in the water.
- b. Admix the glycerol and potato flour, autoclave at 121°C for 15 mins., and cool to room temperature.
- c. Scrub eggs in 5% soap solution. Allow to stand for 30 mins. in soap solution : then rinse thoroughly in cold running water.

- d. Immerse in 70% ethyl alcohol for 15 mins.
- e. Break eggs into a sterile flask. Homogenize by hand shaking and filter through four layers of gauz.
- f. Add homogenized eggs to the potato salt mixture.
- g. Prepare the malachite green and admix thoroughly.
- h. Dispense 5 ml screw-capped tubes.
- i. Slant and inspissate at 85° C for 50 mins.
- j. Incubate for 48 hr at 37° C to check sterility and store at 4° to 20° C.

2. Ogawa and Kudohs' P.D. Media

	<u>Ogawa</u>	<u>Kudohs'P.D.</u>	
KH ₂ PO ₄	3	2	g
Mg citrate	-	0.1	g
Sodium glutamate	1	0.5	g
Soluble starch (Dextrin)	-	3	g
Homogenized egg	200	200	ml
2% Malachite green	5	4	ml
Pyruvic acid	-	0.2	g
Distilled water	100	100	ml

Procedure for Ogawa media

- a. Dissolve KH₂ PO₄, sodium glutamate in distilled water by heating.
- b. Add glycerol, 2% malachite green and homogenized egg and mix together.
- c. Add these mixture to screw-capped tube container (5 ml/tube) and then incubate at 90° C, 90 min in the slope position (45°)
- d. Incubate for 48 hr at 37° C to check sterility and store store at 4°-10° C.

Procedure for Kudohs' P.D. media

- a. Dissolve KH_2PO_4 , sodium glutamate, Mg citrate and dextrin in distilled water and then sterile by autoclave at 121°C , 30 min, then add homogenized egg and then homogenate these mixture.
- b. Add glycerol, 2% malachite green and pyruvic acid, mix together.
- c. Contain these mixture with screw-capped tube container (5 ml/tube) and then incubate at 90°C , 60 min in the slope position (45°C).
- d. Incubate for 48 hr at 37°C to check sterility and store at $4-10^\circ\text{C}$

3. Middlebrook 7H10 media

Solution 1 : keep at room temperature

KH_2PO_4	15	g
K_2HPO_4	15	g
Distilled water	250	ml

Solution 2 : keep at $4-10^\circ\text{C}$

Ammonium sulfate	5	g
Monosodium glutamate	5	g
Sodium citrate. $2\text{H}_2\text{O}$, U.S.P.	4	g
Ferric ammonium citrate	0.4	g
Magnesium sulfate. $7\text{H}_2\text{O}$, A.C.S.	0.5	g
Biotin, in 2 ml of 10% NaOH	5	mg
Distilled water aq	250	ml

Solution 3 : keep at $4-10^\circ\text{C}$

$\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$, A.C.S.	50	mg
$\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$, A.C.S.	100	mg
$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$, A.C.S.	100	mg
Pyridoxine HCl	100	mg
Distilled water aq	100	ml

Solution 4 : keep at room temperature

Glycerol reagent

Solution 5 : keep at 4-10° C, in light-resistant container

Malachite green 0.01% solution

Procedure

a. Distilled water	975 ml
Solution 1	25 ml
Solution 2	25 ml
Solution 3	1 ml
Solution 4	5 ml

Mix these solution together

b. Adjust the pH of these solution to 6.6 by using

6 N HCl

c. Add solution 5, 2.5 ml and agar 15 g

d. Autoclave at 121°C, 15 min

e. After cooling, add OADC enrichment (commercial product)

100 ml, Homogenate and then contain the media with screw-capped tube (5 ml/tube) or plate (20 ml/plate)

4. Middlebrook 7H11 media

Middlebrook 7H10 media	1 litre
Pracreatic digest of casein U.S.P	1.0 g

5. Selective Middlebrook 7H11 media

Middlebrook 7H11 media	1 litre
Carbenicillin	0.05 mg
Amphotericin-B	0.01 mg
Polymyxin-B	20,000 unit
Trimethoprim	0.02 mg

6. Sula liquid media

Na_2HPO_4	2.5	g
KH_2PO_4	1.5	g
Sodium citrate	0.5	g
Asparagine	2.0	g
Alanine	0.15	g
Glycerin	25.00	ml
Ferri ammonium citrate	0.05	g
malachite green (0.2%)	1.00	ml
Distilled water aq	1,000.00	ml

7. Middlebrook 7H9 media

KH_2PO_4	1.0	g
Na_2HPO_4	2.5	g
L-Glutamic	0.5	g
Sodium citrate	0.1	g
Ammonium Sulphate	0.5	g
Pyridoxine	0.001	g
Ferric ammonium citrate	0.04	g
MgSO_4	0.05	g
ZnSO_4	0.001	g
CuSO_4	0.001	g
Biotin	0.5	g
CaCl_2	0.5	g
Distilled water	900	ml
ADC enrichment	100	ml

8. Fluid media

KH_2PO_4	1.5	g
Na_2HPO_4	2.5	g
Sodium citrate	1.5	g
MgSO_4	0.5	g

Casitone	5.0 g
Feric ammonium citrate	0.05 g
Glycerine	25 ml
Malachite green	1 ml
Distilled water aq	1000 ml

9. Kirchner media

$\text{Na}_2\text{HPO}_4 \cdot 12\text{H}_2\text{O}$	19 g
KH_2PO_4	2 g
$\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$	0.6 g
Sodium citrate	2.5 g
L-asparagine	5 g
Glycerine	20 ml
0.4% phenol red	3 ml
Casein hydrolysate	0.5 g
Distilled water aq	900 ml
Calf serum	100 ml

10. Selective Kirchner media

Kirchner media	1 litre
Carbenicillin	100 mg
Amphotericin-B	10 mg
Polymyxin-B	200,000 unit
Trimethoprim	10 mg

11. Transport media

$\text{Na}_3\text{PO}_4 \cdot 12\text{H}_2\text{O}$	200 g
Ammonium sulphate	5 g
MgSO_4	500 mg
Ferric ammonium citrate	250 mg
Penicillin	100,000 unit
Distilled water to	1000 ml

Liquid media procedure

All ingredients were dissolved in distilled water and then sterile by autoclave at 121°C , 15 min, after cooling, Middlebrook 7H9 were added with ADC enrichment in 10% of media volume, Kirchner media were added with calf serum in 10% of media volume and were made selective by the addition of antibiotics, Transport media were also added with penicillin after cooling.

All media were dispensed in Erlenmeyer-flask in amount of 40-50% of container volume, stored at 4° - 10° C.



ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Vitae

Name Mali Wirotasangthong

Education Bachelor of Sciences in Pharmacy in 1987,
the Faculty of Pharmaceutical Sciences,
Chulalongkorn University, Bangkok, Thailand.



ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย