

FACTORS AFFECTING THE
PATHOGENESIS OF EIMERIA NECATRIX
INFECTIONS IN CHICKENS

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50-115

APPENDIX VI

Acetate Buffer, 1.0 M, pH 5.0

141 gm

Sodium acetate

($\text{C}_2\text{H}_3\text{O}_2\text{Na} \cdot 3\text{H}_2\text{O}$)

Dissolve in 1000 ml distilled water.

Glycin - HCl, 0.1 M, pH 2.8

23.57 gm

Glycine

8.2 ml

Concentrated HCl

Dilute to 950.0 ml with distilled water.

Adjust pH to 2.8 with conc. HCl.

Add distilled water up to 1000 ml.

APPENDIX III

Phosphate Buffer, pH 7.2

8.0 gm	Sodium chloride
0.2 gm	Potassium chloride
1.15 gm	Anhydrous disodium hydrogen phosphate
0.2 gm	Potassium dihydrogen phosphate

Dissolve in one litre distilled water and autoclave at 121°C for 15 minutes.

Phosphate Buffer, pH 8.0

Solution A

27.80 gm	Monobasic sodium phosphate (NaH_2PO_4)
1000 ml	Distilled water

Solution B

53.65 gm	Dibasic sodium phosphate ($\text{Na}_2\text{HPO}_4 \cdot 7\text{H}_2\text{O}$)
1000 ml	Distilled water

Mix 5.3 ml of Solution A with 94.7 ml of Solution B and bring up to 200 ml.

APPENDIX II

Sodium Acetate - Acetic Acid Buffer, 0.2 M, pH 3.6

A) 1.15 ml acetic acid in 100 ml distilled water (Solution A)

B) 2.82 gm Sodium acetate in 100 ml distilled water

($C_2H_3O_2 \cdot 3H_2O$) (Solution B)

To prepare pH 3.6 of this buffer, mix 1.63 ml of
Solution A and 0.37 ml of Solution B.

Stain

1 gm Amido Black 10-B

1000 Sodium acetate - acetic acid buffer

Decolorizer 1 (25 minutes)

45 ml Methyl alcohol

10 ml Glacial acetic acid

50 ml Distilled water

Decolorizer 2 (25 minutes)

40 ml Absolute ethyl alcohol

10 ml Glacial acetic acid

50 ml Distilled water

APPENDIX I

Special Sporozoite Stain*

Intestinal tissues were fixed in Bouin's fixative. Paraffin wax-embedded tissues were cut at a thickness of 3-5 um. Sections were stained as follows:

- 1 - Stain nuclei in Ehrlich's hematoxylin for 10 minutes in water, differentiate in acid-alcohol, blue in lithium carbonate (few seconds) and wash in water (1 minute) followed by a rinse in distilled water.
- 2 - Stain in 1% aqueous acid fuchsin for 5 minutes.
- 3 - Wash in running tap water for 1 minute and leave in distilled water for 30 seconds.
- 4 - Transfer to aniline blut-orange G mixture for 30 seconds.
- 5 - Wash in running water to remove excess stain.
- 6 - Dehydrate in 2 changes of iso-propyl alcohol.
- 7 - Clear in xylol and mount in D.P.X.

* Pierce, M.A. 1980. Parasitology 80: 551-554.

ZAMBRASKI, E.J. and B. SCHULER. 1980. Failure of prostaglandin inhibition to attenuate the tolerance to hemorrhage in domestic chickens. Poultry Science 59: 2567-2569.

- WASHBURN, K.W. 1975. Response of chickens with genetically different hemoglobin types to infection with Eimeria tenella and mechanical bleeding. *Avian Diseases* 19: 791-801.
- WAXLER, S.H. 1941. Changes occurring in the blood and tissue of chickens during coccidiosis and artificial hemorrhage. *American Journal of Physiology* 134: 19-26.
- WEINMAN, D. 1952. Toxoplasma and toxoplasmosis. *Annual Review of Microbiology* 6: 281-298.
- WEINMAN, D. and J.H. KLATCHKO. 1950. Description of toxin in toxoplasmosis. *Yale Journal of Biological Medicine* 22: 323-326.
- WEINTRAUB, J. and F. WEINBAUM. 1977. The effect of BCG on experimental cutaneous Leishmaniasis in mice. *The Journal of Immunology* 118: 2288-2290.
- WEISMANN, G. 1975. Introduction. In G. Weismann (ed.), *Mediators of Inflammation*. Plenum Press, New York and London. pp. 1-7.
- WILLIAMS, R.B. 1973. Effects of different infection rates on oocyst production of Eimeria tenella in chickens. *Parasitology* 67: 279-288.
- WOODWORTH, H.C. and D. WEINMAN. 1960. Studies on the toxin of toxoplasma (toxotoxin). *Journal of Infectious Diseases* 107: 318-324.
- WOOLLEY, D.E., E.W. GLANVILLE, D.R. ROBERTS and J.M. EVANSON. 1978. Purification, characterization and inhibition of human skin collagenase. *Biochemical Journal* 169: 265-276.
- WYATT, R.D., M.D. RUFF and R.K. PAGE. 1975. Interaction of aflatoxin with Eimeria tenella infection and moncusin in young broiler chickens. *Avian Diseases* 19: 730-740.

- TURK, D.E. and J.F. STEPHENS. 1970a. Effects of serial inoculations with Eimeria acervulina or E. necatrix upon zinc and oleic acid absorption in chicks. Poultry Science 49: 523-526.
- TURK, D.E. and J.F. STEPHENS. 1970b. Eimeria necatrix and zinc absorption in the chick. Effect of sulphaquinoxaline treatment of the infection. Poultry Science 49: 285-289.
- TYZZER, E.E. 1929. Coccidiosis in gallinaceous birds. American Journal of Hygiene 10: 269-383.
- TYZZER, E.E., H. THEILER and E.E. JONES. 1932. Coccidiosis in gallinaceous birds. II. A comparative study of species of Eimeria of the chicken. American Journal of Hygiene 15: 319-393.
- UITTO, V.J., D. SCHWARTZ and A. VEIS. 1980. Degradation of basement-membrane collagen by neutral proteases from human leukocytes. European Journal of Biochemistry 105: 409-417.
- VAN DOORNINCK, W.M. and E.R. BECKER. 1957. Transport of sporozoites of Eimeria necatrix in macrophages. Journal of Parasitology 43: 40-44.
- VETTERLING, J.M. and D.J. DORAN. 1969. Storage polysaccharide in coccidial sporozoites after excystation and penetration of cells. Journal of Protozoology 16: 772-775.
- VISCO, R.J. and W.C. BURNS. 1972a. Eimeria tenella in bacteriafree and conventional chicks. Journal of Parasitology 58: 323-331.
- VISCO, R.J. and W.C. BURNS. 1972b. Eimeria tenella in monoflora and diflora chicks. Journal of Parasitology 58: 576-585.
- VISCO, R.J. and W.C. BURNS. 1972c. Eimeria tenella in bacteriafree chicks of relatively susceptible strains. Journal of Parasitology 58: 586-588.

- SYKES, A.H. and J. WALTERS. 1970. The digestion and absorption of carbohydrates in chicks infected with intestinal coccidiosis. The Proceedings of the Nutritional Society 30: 29A.
- TAYLOR, A.N. 1978. Immunodiffusion using tissue sections. Journal of Immunological Methods 24: 377-381.
- THOMPSON, J.E., M.A. FERNANDO and J. PASTERNAK. 1979. Induction of gel phase lipid in plasma membrane of chick intestinal cells after coccidial infection. Biochemica Biophysica Acta 555: 472-484.
- TIZARD, I.R., H. NEILSEN, J.R. SEED and J.E. HALL. 1978a. Biologically active products from African Trypanosomes. Microbiological Reviews 42: 661-681.
- TIZARD, I.R., J. SHEPPARD and K. NEILSEN. 1978b. The characterization of a second class of haemolysine from Trypanosoma brucei. Transactions of the Royal Society of Tropical Medicine and Hygiene 72: 198-200.
- TRIFONOV, S., N. SOTIROV and A. FILCHEV. 1977. In vitro migration of peritoneal and spleen cells and its inhibition in some avian species. Cellular Immunology 32: 361-369.
- TURK, D.E. 1973. Calcium absorption during coccidial infections in chicks. Poultry Science 52: 854-857.
- TURK, D.E. 1974. Intestinal parasitism and nutrient absorption. Federation Proceedings 33: 106-111.
- TURK, D.E. and J.F. STEPHENS. 1967. Upper intestinal tract infection produced by Eimeria acervulina and absorption of ZN^{65} and ^{131}I -labelled oleic acid. Journal of Nutrition 93: 161-165.

- SONI, J.L. and H.W. COX. 1975a. Pathogenesis of acute avian malaria. II. Anemia mediated by a cold-active autohemagglutinin from the blood of chickens with acute Plasmodium gallinaceum infection. The American Journal of Tropical Medicine and Hygiene 24: 206-213.
- SONI, J.L. and H.W. COX. 1975b. Pathogenesis of acute avian malaria. III. Antigen and antibody complexes as a mediator of anemia in acute Plasmodium gallinaceum infections of chickens. The American Journal of Tropical Medicine and Hygiene 24: 423-430.
- SONI, J.L. and H.W. COX. 1975c. Pathogenesis of acute avian malaria. IV. Immunologic factors in nephritis of acute Plasmodium gallinaceum infection of chickens. The American Journal of Tropical Medicine and Hygiene 24: 431-438.
- STAFSET, H.J. 1931. Fowl paralysis and the "roup complex". Journal of the American Veterinary Medical Association 78: 423-429.
- STEPHENS, J.F., L.M. KOWALSKI and W.J. BORST. 1967. Some physiological effects of coccidiosis caused by Eimeria maxima in young chickens. Journal of Parasitology 53: 176-179.
- STOCKDALE, P.H.G. 1978. The pathophysiological effects of Eimeria zuerni in calves (Abstract). Fourth International Conference of Parasitology, Warszawa, August 1978. p. 18.
- STOCKDALE, P.H.G. and M.A. FERNANDO. 1975. The development of the lesion caused by second generation schizonts of Eimeria necatrix. Research in Veterinary Science 19: 204-208.
- STOLL, V., K. ENIGK and A. DEY-HAZRA. 1970. The influence of coccidia infection on carbohydrate and ribonucleotides in the liver of chickens. Zeitschrift fur Parasitenkunde 34: 356-361.

- SHARMA, V.D. and M.A. FERNANDO. 1975. Effect of Eimeria acervulina infection on nutrient retention with special reference to fat malabsorption in chickens. Canadian Journal of Comparative Medicine 39: 146-154.
- SHARMA, V.D., M.A. FERNANDO and J.D. SUMMER. 1973. The effect of dietary crude protein level on intestinal and cecal coccidiosis in chickens. Canadian Journal of Comparative Medicine 37: 195-199.
- SHEFFIELD, H.G. and M.L. MELTON. 1968. The fine structure and reproduction of Toxoplasma gondii. Journal of Parasitology 54: 209-226.
- SHUMARD, R.F. 1957. Studies on ovine coccidiosis. I. Some physiological changes taking place in experimental infections with Eimeria ninakahl-yakimovi (Yakimova and Rastegaeva, 1930) and Eimeria faurei (Moussu and Marotel, 1901). Journal of Parasitology 43: 548-554.
- SHUMARD, R.F. and M.E. CALLENDER. 1970. Anticoccidial drugs: screening methods. Experimental Parasitology 28: 13-24.
- SIMPSON, D.M. and R. ROSS. 1971. Effect of heterologous antineutrophil serum in guinea pigs. American Journal of Pathology 65: 79-96.
- SMRKOVSKI, L.L. and C.L. LARSON. 1977. Effect of treatment with BCG on the course of visceral Leishmaniasis in BALB/c mice. Infection and Immunity 16: 249-257.
- SONI, J.L. and H.W. COX. 1974. Pathogenesis of acute avian malaria. I. Immunologic reaction associated with anemia, splenomegaly and nephritis of acute Plasmodium gallinaceum. The American Journal of Tropical Medicine and Hygiene 23: 577-585.

- SABIT, T., W.H. HSIA, M. STANISZ, A. EL-DOMIRI and P.V. ALTEN. 1977. A simple method for obtaining peritoneal macrophages from chickens. *Journal of Immunological Methods* 14: 103-110.
- SAMPSON, J.R. and D.M. HAMMOND. 1972. Fine structural aspects of development of Eimeria alabamensis schizonts in cell culture. *Journal of Parasitology* 58: 311-322.
- SANTORO, F., J. BERNAL and A. CAPRON. 1979. Complement activation by parasites. A review. *Acta Tropica* 36: 5-14.
- SCHILDT, C.D. and C.A. HERRICK. 1955. The effect of cecal coccidiosis on the mobility of the digestive tract of the domestic fowl. *Journal of Parasitology* 41 (No.6, Sect. 2): 18.
- SCHWARTZBERG, J.E., J.L. KRAHELBUHL and J.S. REMINGTON. 1975. Dichotomy between macrophage activation and degree of protection against Listeria monocytogenes and Toxoplasma gondii in mice stimulated with Corynebacterium parvum. *Infection and Immunity* 12: 1037-1043.
- SHARMA, N.N. and J.W. FOSTER. 1964. Toxic substance in various constituents of Eimeria tenella oocysts. *American Journal of Veterinary Research* 25: 211-215.
- SHARMA, N.N. and W.M. REID. 1962. Successful infection of chickens after parenteral inoculation of oocysts of Eimeria sp. *Journal of Parasitology* 48 (Supplement): 33.
- SHARMA, S.D., W.F. PIESSENS and G. MIDDLEBROOK. 1980. In vitro killing of tumor cells by soluble products of activated guinea pig peritoneal macrophages. *Cellular Immunology* 49: 379-383.

- ROSE, M.E., P. HESKETH, B.M. OGILVIE and M. FESTING. 1979b. Failure of nude (athymic) rats to become resistant to reinfection with the intestinal coccidium parasite, Eimeria nieschulzi, or the nematode, Nippostrongylus brasiliensis. *Parasite Immunology* 1: 125-132.
- ROSE, M.E., P.L. LONG and J.W. BRADLEY. 1975. Immune responses to infection with coccidia in chickens: gut hypersensitivity. *Parasitology* 71: 357-368.
- ROSENBERG, M.M. 1941. A study of the inheritance of resistance to Eimeria tenella in the domestic fowl. *Poultry Science* 20: 472.
- RUFF, M.D. and W.M. REID. 1975. Coccidiosis and intestinal pH in chickens. *Avian Diseases* 19: 52-58.
- RUFF, M.D. and W.M. REID. 1977. Avian Coccidia. In J.P. Kreier (ed.), *Parasitic Protozoa, Volume III*. Academic Press, New York, San Francisco, London. pp. 33-69.
- RUFF, M.D., J.K. JOHNSON, D.D. DYKSTRA and W.M. REID. 1974. Effects of Eimeria acervulina on intestinal pH in conventional and gnotobiotic chickens. *Avian Diseases* 18: 96-104.
- RUFF, M.D. and R.D. WYATT. 1978. Influence of dietary aflatoxin on the severity of Eimeria acervulina infection in broiler chickens. *Avian Diseases* 22: 471-480.
- RUFF, M.D., R.D. WYATT and D.R. WITLOCK. 1978. Effect of coccidiosis on blood coagulation in broilers. *Journal of Parasitology* 64: 23-36.
- RYLEY, J.F. 1975. Why and how are coccidia harmful to their host? In A.E.R. Taylor and R. Muller (eds.), *Pathogenic Processes in Parasitic Infection*. Symposium of the British Society for Parasitology, Volume 13. pp. 43-58. Blackwell Scientific Publication.

- ROSE, M.E. 1978. Immune responses of chickens to coccidia and coccidiosis. In P.L. Long, K.N. Boorman and B.M. Freeman (eds.), Avian Coccidiosis. British Poultry Science Ltd., Edinburgh. pp. 297-336.
- ROSE, M.E. and J.W. BRADLEY. 1977. Delayed hypersensitivity in the fowl, turkey and quail. Avian Pathology 6: 313-326.
- ROSE, M.E. and P. HESKETH. 1976. Immunity to coccidiosis: stages of the life-cycle of Eimeria maxima which induce, and are affected by, the response of the host. Parasitology 73: 25-37.
- ROSE, M.E. and P. HESKETH. 1979. Immunity to coccidiosis: T-lymphocyte or B-lymphocyte deficient animals. Infection and Immunity 26: 630-637.
- ROSE, M.E. and P.L. LONG. 1962. Immunity to four species of Eimeria in fowl. Immunology 5: 79-92.
- ROSE, M.E. and P.L. LONG. 1969. Immunity to coccidiosis: gut permeability changes in response to sporozoite invasion. Experientia 25: 183-184.
- ROSE, M.E. and P.L. LONG. 1970. Resistance to Eimeria infections in the chicken: the effect of thymectomy, bursectomy, whole body irradiation and cortisone treatment. Parasitology 60: 291-299.
- ROSE, M.E., P. HESKETH and B.M. OGILVIE. 1979a. Peripheral blood leucocyte response to coccidial infection: a comparison of the response in rats and chickens and its correlation with resistance to reinfection. Immunology 36: 70-79.