

REARING OF PRIMARY S.P.F. PIGS BY GNOTOBIOTIC METHODS.  
O.P. MINIATS, DEPARTMENT OF CLINICAL STUDIES,  
ONTARIO VETERINARY COLLEGE,  
UNIVERSITY OF GUELPH  
GUELPH, ONTARIO, CANADA

### INTRODUCTION

In 1959 a voluntary government supervised "Certified Herd Plan" was introduced in the province of Ontario, Canada for the control of enzootic pneumonia, atrophic rhinitis and external parasites in swine. The herds that enrolled in this program were established from caesarian derived stock, and the health status was monitored by the Veterinary Services Branch.

The procurement and rearing of the primary specific pathogen free (S.P.F.) pigs, was conducted at the Ontario Veterinary College. Initially the piglets were reared in brooders under sanitary, but not positively microbiologically controlled conditions (1,3,7). Since 1972 gnotobiotic technology has been applied. A summary of the methods of derivation and rearing is provided with data regarding survival and performance.

### METHODS

The artificially reared piglets were derived either by closed hysterotomy (20 litters) or by the open caesarian-germicidal trap method (5) (165 litters), and introduced into sterile isolators. At one week of age, the germfree pigs were given cultures of lactobacilli, fecal streptococci and a non-virulent strain of *Escherichia coli* orally. They were maintained in a gnotobiotic state associated with the three organisms until four weeks of age. Then the pigs were moved to thoroughly disinfected conditioning rooms where they were exposed to a normal microbial environment. At six weeks of age the pigs were shipped to the farms as foundation stock or as additions. On other occasions caesarian piglets were placed immediately after delivery on foster sows in the recipient herds.

The pigs raised in isolators were fed limited quantities of sterile condensed cow's milk and injected i.m. with 34 I.U. of vitamin E and 0.8 mg of selenium on day one, and with 200 mg of iron at three days of age. At three weeks of age sterilized pig starter pellets were offered free choice. A week later the milk was gradually withdrawn and the diet was changed to non-sterile commercial starter pellets and water.

### RESULTS

Exposure of the gnotobiotic pigs to the selected non-pathogenic bacteria did not result in detectable disease. Histological, hematological and blood serum examinations indicated that the organisms stimulated the development of their lymphoid organs associated with the digestive tract (4), their cellular defence mechanisms and gamma globulin synthesis (6). The survival rates of the animals, while reared in the laboratory is presented in Table I.

TABLE I  
PRODUCTION AND SURVIVAL OF PRIMARY SPF PIGS  
AT THE OVC LABORATORY 1970-81

Year	# Lit.		Pigs Reared in Isolators			
	Caes.	Fost.	# Lit.	# Pigs	% Survival	St. Dev.
1970	41	34	7	65	62*	35
1971	23	19	4	32	55*	41
1972	51	50	1	9	89	-
1973	29	23	6	48	70	23
1974	17	10	7	58	80	26
1975	13	1	12	106	78	30
1976	51	37	14	131	96	9
1977	36	25	11	123	77	24
1978	49	14	35	326	84	20
1979	47	26	21	227	87	20
1980	101	63	38	360	76	27
1981	63	24	29	210	85	19
TOTAL	511	326	185	1697	MEAN	MEAN
					70-71	38
					72-81	22

\*The 1970 to 1971 values are those for brooder reared pigs and the values 1972 to 1981 are for pigs reared by gnotobiotic methods.

The average survival rates calculated on a yearly basis for pigs reared by the brooder method were approximately 60 percent and of those reared by gnotobiotic techniques about 82 percent. The principal causes of piglet mortality were congenital abnormalities, immaturity and failure to eat and occasionally infections transmitted either vertically, or due to isolator failure. On the S.P.F. farms where management practices were generally good the incidence of infectious diseases in these pigs has been reported to be low.

The average weight of the artificially reared S.P.F. pigs at six weeks of age was 10.1 kg, as compared to 7.3 kg for germfree pigs fed condensed milk only and 14.2 kg for suckling conventional pigs. Despite this disparity, according to reports of the S.P.F. swine breeders, the artificially reared additions reach or surpass in weights, the pigs of equal age reared in the herd within two months.

### DISCUSSION

The prime purpose for the surgical derivation and artificial rearing of primary S.P.F. pigs is the prevention of transmission of specific swine pathogens from the sow to its offspring. While this can be readily achieved (1,2,5), the hazard however, exists that being deprived of colostrum, these pigs lack maternal antibody and are highly susceptible to infections by any potential pathogen (6,7). The exclusion of non-desirable microbes by gnotobiotic technology and the planned exposure of the animals to a limited harmless bacterial flora during the first few weeks of life were designed to provide both protection and antigenic stimulation. The low incidence of infectious disease while the piglets were reared in the laboratory and after their placement on the farms indicate that the methods described were effective in both respects.

### CONCLUSIONS

The results of this work indicate that by the application of gnotobiotic technology and by the exposure to a limited harmless bacterial flora colostrum deprived primary S.P.F. pigs can be reared as successfully as conventional suckling pigs under good management conditions. They offer the advantage of minimizing the risk of transmission of infectious diseases when introduced into swine herds.

### SELECTED REFERENCES

- 1) Alexander, T.J.L. and C.K. Roe. *Can. vet. J.* 3:299-306, 1962.
- 2) Alexander, T.J.L. et al. *Can. vet. J.* 10:98-105, 1969.
- 3) Haelterman, E.O. *Am. J. vet. Res.* 17:129-131, 1956.
- 4) Miniats, O.P. and V.E. Valli. In *Germfree Research* J.B. Henneghan Ed. 575-583, Academic Press, 1973.
- 5) Miniats, O.P. and D. Jol. *Can. J. comp. Med.* 42:428-437, 1978.
- 6) Miniats, O.P. and V.E. Valli. *Clin. and Experim. Gnotobiotics*, Zbl. Bakt. Suppl. 7:145-149, Gustav Fisher Verl. 1979.
- 7) Roe, C.K. and T.J.L. Alexander. *Can. vet. J.* 2:139-142, 1961.