GPO PRICE $ _____

OTS PRICE(S) $ _____

Hard copy (HC) $1.00

Microfiche (MF) .50

REPUBLIC
AVIATION CORPORATION

Quarterly Progress Report

Covering Period: January 1 - March 31, 1965

Study of the Normal Fecal Bacterial Flora of Man

RAC 931-7

Prepared Under Contract NASw-738

by

Dr. Lorraine S. Gall

Republic Aviation Corporation
Space Environment and Life Sciences Laboratory
Farmingdale, L. I., New York

Republic Aviation Corporation
Farmingdale, Long Island, New York
SPACE ENVIRONMENT & LIFE SCIENCES LABORATORY

March 31, 1965

Quarterly Progress Report (JANUARY, FEBRUARY, MARCH, 1965)
Contract NASw-738
Study of the Normal Fecal Bacterial Flora of Man

INTRODUCTION

The work conducted this quarter consisted of primary isolation of the predominating fecal flora of the normal human male and further physiological studies on the sixteen type cultures. Some of the work is sufficiently complete to be partially summarized and is included in tables in this report.

ISOLATION OF PREDOMINATING FECAL BACTERIA

During this quarter primary isolation of predominating fecal anaerobes in nine subjects was completed and the distribution of these organisms is included in Tables 1 through 10. In Table 11 the distribution of the various type cultures between the first and second groups of subjects has been compared and in Table 12 the type cultures have been grouped according to frequency of occurrence. The aerobic plate count in millions, the heighth of the anaerobic plate count by tubes and the number of times strict anaerobes vs facultative anaerobes occurred appears in Tables 13, 14 and 15.

Tables 13, 14 and 15 represent the completion of similar tables found in quarterly report RAC 931-6 and show essentially that the aerobes are present in much smaller numbers than the anaerobes and that in general persons showing a high aerobic count retained this characteristic through out the series and visa versa. The anaerobes continued to occur in large numbers usually equaling and exceeding a 100 billion per gram of feces.

As has been found repeatedly the facultative anaerobes in the top three dilutions of feces showing growth represent only a small proportion of the predominating flora and over 90% of the predominating bacteria were strict anaerobes. One subject, #18, was the exception and is the only subject in the nineteen men so far studied that appears to carry a high proportion of facultative anaerobes. In two sampling periods in which growth was obtained in the tenth and last tube of the series, representing over a trillion organisms per gram, all of the most predominating organisms were facultative anaerobes. However, on the anaerobic brewer plates poured from the

same sample many obligate anaerobes were shown to be present. Since facultative anaerobes usually overgrow strict anaerobes in broth, it is not surprising that the result of picking individual colonies was different from that obtained from the broth dilution series. Summarizing the results from all nine subjects, 91% of the organisms isolated from the top three dilutions were obligately anaerobic, but by omitting subject 18 the percentage rose to 95%, which is more in keeping with our previous findings.

The distribution of the anaerobes is given for each subject in Tables 1 through 9 and it should be noted that the number of organisms which would not fit the "key" for type cultures is substantially lower on these nine subjects than on the previous ten. This would be expected since more experience has been gained in interpreting slight variations from the pattern set down for type cultures.

The distribution of the type cultures for all nine subjects is presented in Table 10 and it can be seen that relatively large numbers of FA-15, FA-3, FA-5, FA-1, FA-6 and FA-12 occurred on both tests. In Table 12 the organisms are separated into those which occur most frequently and the numbers in the table show the order of predominance of the cultures in each of the two series, and the "total" shows the overall frequency of occurrence. It is interesting to note that the same six anaerobes were the most frequently occurring in both series of tests, and the least frequently occurring anaerobes also showed good agreement between the two groups of men. It would thus appear that the subjects studied carried somewhat similar predominating anaerobic fecal flora.

Six more subjects are being studied by similar procedures and the results from these six men will be compared with those obtained from the nineteen men previously studied.

PHYSIOLOGICAL RESULTS

The supernatant fluid from fourteen of the type cultures were tested to show the ability of the type cultures to produce or use certain vitamins. The cultures were grown in broth containing minimal amounts of the B vitamins. The cultures were tested with respect to vitamin B_{12}, riboflavin, niacin, pantothenic acid and folic acid and the results are tabulated in Table 16. It can be readily seen that most of the organisms produced vitamin B_{12}, some in quite copious amounts. Riboflavin was produced in relatively small amounts by some of the cultures and was used by two cultures, while niacin was not produced by any cultures and was used by most. Pantothenic acid was produced in small amounts by some cultures, while one culture showed rather substantial production. On the other hand some cultures used pantothenic acid, some in rather substantial amounts. Folic acid was produced in varying amounts by several cultures varying from rather small amounts, to copious amounts by two cultures. The pattern of vitamin production or use proved to be quite interesting, since certain organisms that used one or two of the B vitamins were capable of producing rather large quantities of others. For example, there frequently appears to be a symbiosis between FA-1 and FA-3. It is interesting to note that pantothenic acid is produced by FA-1 and used by FA-3. There may be a pattern between the production and use of these B vitamins by organisms that are frequently found in symbiotic combination.

The principal physiological characteristics of the type cultures which have not been presented in the screening tests for these organisms are summarized in Table 17. These include production of lactic acid and gas from glucose, decarboxylation and deamination activities, and B vitamin production or use. Using certain of these characteristics to assess the possible principal functions of these bacteria in the body, it was possible to separate the majority of these organisms into two main groups. One group is comprised of those organisms which apparently are principally carbohydrate fermenters and the others appear to be predominantly protein oriented in their metabolism as is shown by their ability to deaminate or decarboxylate amino acids. Four organisms do not fall clearly into either class as they present important characteristics which separate them from the organisms in both of the two previous groups. This finding is of importance in interpreting the data with respect to the function of each organism in the body, (See Table 18).

Table 19 presents the data obtained in the collaborative work conducted in conjunction with Dr. Henry A. Dymsza, Dr. G. S. Stoewsand, and Dr. J. J. Enright at the Metabolism Section, Nutrition Branch of Food Division, U. S. Army Natick Laboratories, and Dr. P. C. Trexler, of Gnotobiotic Foundation, North Wilmington, Massachusetts. It can be seen that type cultures FA-9 and FA-15 cause a significant rise in the plasma cholesterol of the germ-free rats and FA-9 caused an elevation in the liver cholesterol of these animals. Further studies of this nature are in progress.

PROJECTED WORK FOR NEXT QUARTER

During the next quarter it is anticipated that primary isolations from the third series of six subjects will be completed and that the summarizing of the data on the entire study obtained will occupy the major portion of the work.

PROJECT PERSONNEL

Personnel who have been working on the program are Dr. Lorraine S. Gall, Mr. Charles Huhtanen, Dr. Helen Osburg, Mrs. Fay Ames and Mrs. Shirley Dunwoody.

HOURS EXPENDED: (January 1 - March 31, 1965)

Professional: 396

Technical: 534

L. Gall

Lorraine S. Gall, Ph. D.

LSG/bs

TABLE 1

Distribution of Anaerobes in Fecal Samples
From Human Subject 11

Anaerobes	Sample Number						
	1	2	3	4	5	6	Total
FA-1	1	3	2	1	2		9
FA-2	1						1
FA-3	2		3				5
FA-4							
FA-5		3			1	1	5
FA-6			1	1			2
FA-7							
FA-8							
FA-9							
FA-10							
FA-11							
FA-12			4				4
FA-13							
FA-14							
FA-15	2		1				3
FA-16							
FA-17			1	1			2
FA-18				2			2
GD-1							
GD-2							
GD-3	1						1
GD-4							
GD-5							
GD-6							
GD-7							
Unkeyed	1	1		2			4
TOTAL	8	7	12	7	3	1	38
FN-1	1						1
FN-2	1						1
FN-3							
FN-4							
Lactobacillus							
Enterococci							
Unkeyed							
TOTAL	2	0	0	0	0	0	2

FA & GD = Obligate Anaerobes
FN = Facultative Anaerobes

TABLE 2

Distribution of Anaerobes in Fecal Samples From Human Subject 12

Anaerobes	Sample Number						
	1	2	3	4	5	6	Total
FA-1	4	3					7
FA-2							
FA-3	4						4
FA-4							
FA-5	4	5					9
FA-6							
FA-7							
FA-8							
FA-9							
FA-10		1					1
FA-11							
FA-12		1					1
FA-13							
FA-14	1						1
FA-15	2	2	4	2			10
FA-16							
FA-17							
FA-18							
GD-1							
GD-2							
GD-3							
GD-4							
GD-5							
GD-6							
GD-7							
Unkeyed	3		2	1			6
TOTAL	18	12	6	3	0	0	39
FN-1							
FN-2							
FN-3							
FN-4		1					1
Lactobacillus							
Enterococci	1						1
Unkeyed							
TOTAL	1	1	0	0	0	0	2

FA & GD = Obligate Anaerobes
FN = Facultative Anaerobes

TABLE 3

Distribution of Anaerobes in Fecal Samples From Human Subject 13

Anaerobes	Sample Number						
	1	2	3	4	5	6	Total
FA-1	1	1	1				3
FA-2	1	1					2
FA-3							
FA-4							
FA-5		2					2
FA-6	1			1			2
FA-7							
FA-8							
FA-9							
FA-10							
FA-11	1						1
FA-12							
FA-13			1				1
FA-14							
FA-15	2	2	5	1	2		12
FA-16							
FA-17				1			1
FA-18							
GD-1							
GD-2							
GD-3							
GD-4			1				1
GD-5							
GD-6							
GD-7							
Unkeyed				1			1
TOTAL	6	6	8	4	2	0	26
FN-1							
FN-2							
FN-3							
FN-4							
Lactobacillus			2		1		3
Enterococci							
Unkeyed		2	1				3
TOTAL	0	2	3	0	1	0	6

FA & GD = Obligate Anaerobes
FN = Facultative Anaerobes

TABLE 4

Distribution of Anaerobes in Fecal Samples From Human Subject 15

Anaerobes	Sample Number						
	1	2	3	4	5	6	Total
FA-1		7	4	1	1		13
FA-2		1		2			3
FA-3				1	1		2
FA-4				1			1
FA-5		3	5	3	1		12
FA-6	1				1		2
FA-7							
FA-8							
FA-9							
FA-10							
FA-11							
FA-12							
FA-13							
FA-14							
FA-15	1	1	2	2		1	7
FA-16	1			1		1	3
FA-17							
FA-18					1	1	2
GD-1							
GD-2							
GD-3							
GD-4							
GD-5							
GD-6							
GD-7							
Unkeyed	1		2	1			4
TOTAL	4	12	13	12	5	3	49
FN-1							
FN-2							
FN-3							
FN-4							
Lactobacillus		1					1
Enterococci							
Unkeyed							
TOTAL	0	1	0	0	0	0	1

FA & GD = Obligate Anaerobes
FN = Facultative Anaerobes

TABLE 5

Distribution of Anaerobes in Fecal Samples
From Human Subject 16

Anaerobes	Sample Number						
	1	2	3	4	5	6	Total
FA-1		2	3	2	1	1	9
FA-2							
FA-3		1					1
FA-4							
FA-5			4			1	5
FA-6							
FA-7							
FA-8	3			2			5
FA-9							
FA-10		3					3
FA-11							
FA-12	3						3
FA-13							
FA-14						2	2
FA-15		2			2		4
FA-16					2		2
FA-17							
FA-18		4					4
GD-1							
GD-2							
GD-3		1	1				2
GD-4							
GD-5							
GD-6		1					1
GD-7							
Unkeyed	1	1		1	2		5
TOTAL	7	15	8	5	7	4	46
FN-1				1			1
FN-2							
FN-3							
FN-4							
Lactobacillus							
Enterococci							
Unkeyed							
TOTAL	0	0	0	1	0	0	1

FA & GD = Obligate Anaerobes
FN = Facultative Anaerobes

TABLE 6

Distribution of Anaerobes in Fecal Samples From Human Subject 17

Anaerobes	Sample Number						
	1	2	3	4	5	6	Total
FA-1					2		2
FA-2	1						1
FA-3	2						2
FA-4							
FA-5		1		1			2
FA-6	2			1	1		4
FA-7							
FA-8							
FA-9							
FA-10	1						1
FA-11							
FA-12			3	1			4
FA-13							
FA-14	1			3			4
FA-15	3				1		4
FA-16							
FA-17							
FA-18	1						1
GD-1							
GD-2			2				2
GD-3							
GD-4							
GD-5							
GD-6							
GD-7							
Unkeyed	1						1
TOTAL	12	1	5	6	4	0	28
FN-1							
FN-2							
FN-3							
FN-4							
Lactobacillus							
Enterococci							
Unkeyed							
TOTAL	0	0	0	0	0	0	0

FA & GD = Obligate Anaerobes
FN = Facultative Anaerobes

TABLE 7

Distribution of Anaerobes in Fecal Samples From Human Subject 18

Anaerobes	Sample Number						
	1	2	3	4	5	6	Total
FA-1		6	2				8
FA-2		1				1	2
FA-3			2		1		3
FA-4							
FA-5		2					2
FA-6					1		1
FA-7						1	1
FA-8	4						4
FA-9							
FA-10			1				1
FA-11							
FA-12	1				1	4	6
FA-13				1			1
FA-14			1				1
FA-15	2	1	1	1	2		7
FA-16							
FA-17	1			1			2
FA-18							
GD-1							
GD-2							
GD-3					1		1
GD-4							
GD-5							
GD-6							
GD-7							
Unkeyed	1	3		1	1	1	7
TOTAL	9	13	7	4	7	7	47
FN-1							
FN-2							
FN-3							
FN-4							
Lactobacillus							
Enterococci							
Unkeyed		3		3			6
TOTAL	0	3	0	3	0	0	6

FA & GD = Obligate Anaerobes
FN = Facultative Anaerobes

TABLE 8

Distribution of Anaerobes in Fecal Samples From Human Subject 19

Anaerobes	Sample Number						
	1	2	3	4	5	6	Total
FA-1		3	2	3	1		9
FA-2							
FA-3	1		4				5
FA-4							
FA-5				3			3
FA-6		1				1	2
FA-7	1						1
FA-8	1					1	2
FA-9			1	1		1	3
FA-10	1		1				2
FA-11	1						1
FA-12							
FA-13		1					1
FA-14			1				1
FA-15	1	2	2	2	1		8
FA-16							
FA-17		1			1		2
FA-18					1		1
GD-1							
GD-2		1					1
GD-3			4			1	5
GD-4							
GD-5							
GD-6					1		1
GD-7							
Unkeyed	1	3	1	1			6
TOTAL	7	12	16	10	5	4	54
FN-1							
FN-2							
FN-3							
FN-4							
Lactobacillus			1				1
Enterococci			1				1
Unkeyed							
TOTAL	0	0	2	0	0	0	2

FA & GD = Obligate Anaerobes
FN = Facultative Anaerobes

TABLE 9

Distribution of Anaerobes in Fecal Samples From Human Subject 20

Anaerobes	Sample Number						
	1	2	3	4	5	6	Total
FA-1	3				1	1	5
FA-2							
FA-3							
FA-4							
FA-5		2	2	4			8
FA-6			1	3		1	5
FA-7							
FA-8					1		1
FA-9							
FA-10			1				1
FA-11							
FA-12							
FA-13							
FA-14							
FA-15						1	1
FA-16							
FA-17					1		1
FA-18	2	1					3
GD-1							
GD-2							
GD-3						1	1
GD-4							
GD-5							
GD-6							
GD-7							
Unkeyed	1		2	1			4
TOTAL	6	3	6	8	3	4	30
FN-1							
FN-2							
FN-3							
FN-4							
Lactobacillus		1					1
Enterococci							
Unkeyed							
TOTAL	0	1	0	0	0	0	1

FA & GD = Obligate Anaerobes
FN = Facultative Anaerobes

TABLE 10

Summary of Results from All Subjects by Sample Period

Anaerobes	Sample Number						
	1	2	3	4	5	6	Total
FA-1	9	25	14	7	8	2	65
FA-2	3	3	0	2	0	1	9
FA-3	9	1	9	1	2	0	22
FA-4	0	0	0	1	0	0	1
FA-5	4	18	11	11	2	2	48
FA-6	4	1	2	6	3	2	18
FA-7	1	0	0	0	0	1	2
FA-8	8	0	0	2	1	1	12
FA-9	0	0	1	1	0	1	3
FA-10	2	4	3	0	0	0	9
FA-11	2	0	0	0	0	0	2
FA-12	4	1	7	1	1	4	18
FA-13	0	1	1	1	0	0	3
FA-14	2	0	2	3	0	2	9
FA-15	13	10	15	8	8	2	56
FA-16	1	0	0	1	2	1	5
FA-17	1	1	1	3	2	0	8
FA-18	3	5	0	2	2	1	13
GD-1	0	0	0	0	0	0	0
GD-2	0	1	2	0	0	0	3
GD-3	1	1	5	0	1	2	10
GD-4	0	0	1	0	0	0	1
GD-5	0	0	0	0	0	0	0
GD-6	0	1	0	0	1	0	2
GD-7	0	0	0	0	0	0	0
Unkeyed	10	8	7	9	3	1	38
TOTAL	77	81	81	59	36	23	357
FN-1	1	0	0	1	0	0	2
FN-2	1	0	0	0	0	0	1
FN-3	0	0	0	0	0	0	0
FN-4	0	1	0	0	0	0	1
Lactobacillus	0	2	3	0	1	0	6
Enterococci	1	0	1	0	0	0	2
Unkeyed	0	5	1	3	0	0	9
TOTAL	3	8	5	4	1	0	21

FA & GD = Obligate Anaerobes
FN = Facultative Anaerobes

TABLE 11

Distribution of Type Cultures Isolated on First Two Series

Type Culture	1st Run	2nd Run	Total
FA-1	20	65	85
FA-2	12	9	21
FA-3	26	22	48
FA-4	4	1	5
FA-5	20	48	68
FA-6	17	18	35
FA-7	2	2	4
FA-8	12	12	24
FA-9	2	3	5
FA-10	12	13	25
FA-11	7	2	9
FA-12	16	18	34
FA-13	2	3	5
FA-14	16	9	25
FA-15	27	54	81
FA-16	8	5	13
FA-17	11	8	19
FA-18		13	13

TABLE 12

Six Most Frequently Occurring Fecal Anaerobes

Type Culture	1st Run	2nd Run	Total
FA-15	1	2	2
FA-3	2	4	4
FA-1	3-4	1	1
FA-5	3-4	3	3
FA-6	5	5-6	5
FA-12	6-7	5-6	6

Six Fecal Anaerobes Showing Intermediate Occurrence

FA-14	6-7	10-11	7-8
FA-2	8-9-10	10-11	10
FA-8	8-9-10	9	9
FA-10	8-9-10	7-8	7-8
FA-17	11	12	11
FA-16	12	13	12-13

Six Least Frequently Occurring Fecal Anaerobes

FA-11	13	16-17	14
FA-4	14	18	15-16-17
FA-7	15-16-17	16-17	18
FA-9	15-16-17	14-15	15-16-17
FA-13	15-16-17	14-15	15-16-17
FA-18		7-8	12-13

Numbers refer to order of frequency of occurrence within each series.

TABLE 13

Aerobic Plate Count in Millions

Subject No.	Sample Number					
	1	2	3	4	5	6
11	130	75	10	37	35	25
12	50	71	90	14		
13	4	8	.6	0	1	
15	136	missing	200	210	400	190
16	72	0	1	35	0	55
17	20	24	18	160	150	
18	700	800	300	15	400	560
19	35	1	3	2	600	45
20	1	1	17	0	17	

TABLE 14

Heighth of Anaerobic Growth by Tube*

Subject No.	Sample Number					
	1	2	3	4	5	6
11	8	9	7	8	9	8
12	9	10	10	10		
13	9	8	9	9	9	
15	10	9	10	10	9	8
16	10	8	9	8	9	8
17	8	9	7	9	8	
18	10	10	9	10	9	8
19	9	8	9	10	9	10
20	10	8	9	8	8	7

*(Tube 7 = 10^{-10}; 8 - 10^{-11}; etc.)

TABLE 15

Number of Times Strict Anaerobes vs Facultative Anaerobes
Appeared in the Top Three Dilutions of Growth

Subject No.	Sample Number											
	1		2		3		4		5		6	
	A	F	A	F	A	F	A	F	A	F	A	F
11	2	1	3	0	3	0	2	1	3	0	3	0
12	2	1	2	1	3	0	3	0				
13	3	0	3	0	3	0	3	0	3	0		
15	3	0	3	0	2	1	3	0	2	1	3	0
16	3	0	3	0	3	0	3	0	3	0	3	0
17	3	0	3	0	3	0	2	1	3	0		
18	3	0	0	3	3	0	0	3	3	0	2	1
19	3	0	3	0	3	0	3	0	3	0	3	0
20	3	0	3	0	3	0	3	0	3	0	3	0
Totals	25	2	23	4	26	1	22	5	23	1	17	1

A = Strict Anaerobes
F = Facultative Anaerobes

TABLE 16

B Vitamin Production or Use by the Type Cultures

Type Culture	Vitamin B-12 mμ/cc	Riboflavin μ/cc	Niacin μ/cc	Pantothenic Acid μ/cc	Folic Acid mμ/cc
FA-1	0.288	0.096	3.1	0.37	35.0
FA-2	0.237	0.078	3.6	0.37	14.5
FA-3	0.125	0.099	3.0	0.0463	10.0
FA-5	0.262	0.102	3.2	0.0814	15.5
FA-6	0.262	0.093	3.35	0.243	16.5
FA-7	0.262	0.093	2.65	0.393	25.0
FA-8	0.225	0.087	3.60	0.532	14.5
FA-9	0.362	0.078	2.45	0.208	15.5
FA-10	0.400	0.084	2.74	0.301	25.0
FA-12	0.325	0.090	2.65	0.359	17.0
FA-13	0.300	0.111	3.10	0.0116	35.0
FA-14	0.200	0.114	2.50	0.0231	11.0
FA-15	0.255	0.096	3.40	0.301	10.0
FA-16	0.0953	0.093	3.6	0.254	10.5
Control	0.084	0.084	3.6	0.254	10.0

TABLE 17

Physiological Characteristics of the Predominating Fecal Anaerobes

Type Culture	Morphology	Agar Shake	pH Broth*	Deamination % Substrate Converted to NH_3	Decarboxylation				% Lactic Acid/ Wt. Glucose	Gas From Glucose	Vitamins				
					Lysine	Histidine	Tyrosine	Arginine			B_{12}	B_2	Niacin	P. A.	Folic Acid
FA-1	sl gr + rods	v an	7.0 4.6	13	0	+	+	+	5		+	0	0	+	+
FA-2	sl gr + rod, tadpole	v an	6.4 4.5	<2	0	0	0	+	26		+	-	0	+	+
FA-3	gr neg elongate pt rds in pr	v an heavy gas	7.5 6.1	6	+	+	+	+	9	CO_2	+	0	0	-	0
FA-4	sl gr + rods	v an	5.6 4.65	<2	0	0	0	0	39		X	X	X	X	X
FA-5	sl med gr + rod clusters	v an	5.5 4.55	2	0	0	0	0	40		+	+	0	-	+
FA-6	gr + med rods clusters	v an	6.6 4.45	<2	0	0	0	0	9		+	0	0	0	+
FA-7	sm gr neg sl rod bipolar	v an	6.6 4.85	12	0	+	+	+	28		+	0	-	+	+
FA-8	tiny gr neg sl rods, sl curve	v an	6.9 8.0	23	0	+	+	0	28		+	0	0	+	+
FA-9	pleo gr + rod hooked chains	v an	7.0 4.85	16	+	+	+	+	26		+	-	-	-	+

* Top number pH = 1/10% glucose heavily buffered
Bottom = 5/10% glucose not buffered

X Test not done

TABLE 17 (Cont'd)

Type Culture	Morphology	Agar Shake	pH Broth*	Deamination % Substrate Converted to NH_3	Decarboxylation				% Lactic Acid/ Wt. Glucose	Gas From Glucose	Vitamins				
					Lysine	Histidine	Tyrosine	Arginine			B_{12}	B_2	Niacin	P. A.	Folic Acid
FA-10	v sm gr + rods in chain bipolar pl pt	v an	6.7 4.90	12	+	+	+	+	20	CO_2	+	0	-	+	+
FA-11	sh med gr + rods	v an	6.5 4.5	2	X	0	0	0	37		X	X	X	X	X
FA-12	tiny pt gr + rods chains coccoid	v an occ sl gas	7.2 4.65	28	+	+	+	+	19		+	0	-	+	+
FA-13	sm gr neg cocci in masses	v an hvy gas	6.7 8.1	2	(+)	(+)	(+)	(+)	used		+	+	0	-	+
FA-14	gr neg rods long sl with gr + areas	v an hvy gas	6.7 5.3	2	+	+	+	+	9	CO_2H_2	+	+	-	-	0
FA-15	sh fat gr neg rods pt ends	v an hvy gas	6.7 4.65	9	0	0	0	+	21		+	0	0	+	0
FA-16	gr + pleo rods tadpole	anaerobic collar	6.8 4.62	2	0	0	0	+	40		0	0	0	0	0

* Top number pH = 1/10% glucose heavily buffered
Bottom = 5/10% glucose not buffered

X = Test not done
( ) = Questionable results due to gas formation by culture

TABLE 18

Lactic Acid Forming Predominating Fecal Anaerobes

Type Culture	% Lactic Acid/ Wt. Glucose	% Substrate Converted to NH_3	Decarboxylation			
			Lysine	Histidine	Tyrosine	Arginine
FA-2	26	2	0	0	0	+
FA-4	39	2	0	0	0	0
FA-5	40	2	0	0	0	0
FA-11	37	2	X	0	0	0
FA-16	40	2	0	0	0	+
FA-6	9	2	0	0	0	0

Deaminating and Decarboxylating Predominating Fecal Anaerobes

FA-1	5	13	0	+	+	+
FA-9	26	16	+	+	+	+
FA-10	20	12	+	+	+	+
FA-12	19	28	+	+	+	+
FA-7	28	12	0	+	+	+
FA-8	28	23	0	+	+	0

Miscellaneous Predominating Fecal Anaerobes

FA-3	9	6	+	+	+	+
FA-13	used	2	(+)	(+)	(+)	(+)
FA-14	9	2	+	+	+	+
FA-15	21	9	0	0	0	+

( ) = Questionable results due to gas formation by culture
X = Test not done

TABLE 19

Effect of Four Predominating Fecal Anaerobes on Germ Free Rats

Type Culture	3-Wk. Body Wt. Gain (gm)	Cecum as % of Body Wt.	Plasma Cholesterol	Liver Cholesterol
Germ-free	74 ± 3	7.1	95 ± 3	2.52 ± 0.11
FA-1	95 ± 5	6.8	97 ± 10	2.78 ± 0.28
FA-9	80 ± 5	6.2	124 ± 6	3.26 ± 0.16
FA-13	98 ± 2	5.6	99 ± 9	2.16 ± 0.10
FA-15	91 ± 2	5.1	158 ± 13	2.64 ± 0.18