

which proves inert after a subcutaneous injection may be virulent for an intrajugular injection.

4. The intrajugular injection of large doses of inert virus does not produce immunity.

5. It is clear that a certain virus may become inert, and therefore this fact influences the preparation and preservation of virus to be used in practice.

F.—ON THE VARIABILITY OF THE VIRULENCY OF A PARTICULAR STRAIN OF HORSE-SICKNESS VIRUS.

Hitherto it has been the experience that a virus of horse-sickness taken at random and injected into susceptible horses or mules, irrespective of quantity or method, has in every instance resulted in reactions, and in the great majority deaths followed. This is borne out by the fact that the simultaneous injections of mules with two or more vira and serum resulted in every instance with immunity against that particular virus, or at least in all instances which were tested with that particular strain (compare Annual Report, 1906-07). After the introduction of the Tzaneen virus into practice, and after the apparent failure of this virus in Natal, it became necessary to elucidate the cause, and a new feature was evident, namely, the variability of the virus. This formed the subject of an extended investigation, the details of which are given hereunder. The tables explain themselves, and I only need refer to the terms "Type" and "Strain."

All the different horse, mule, and donkey vira utilised for the following injections are of the same origin (that is of the same strain, Tzaneen), but owing to the numbers of animals used, I have divided them into six tables with the object of making the experiment more comprehensible.

Virus Tzaneen 1087 is the origin; virus 1965 is the first generation, and the main injections with this virus appear under type 1965 (Experiment No. 1). From virus of the third generation of this type (Natal virus) a mule, 2415, was injected, and main injections with virus of this sub-origin form a separate type, 2415 (Experiment No. 2). A second branch was formed by this Natal virus, called type 2891 (Experiment No. 3). Type 2415 was again divided, the mule 2539 forming a type (Experiment No. 4). Similarly with type 2694 (Experiment No. 5) and with type 2732 (Experiment No. 6), these also being branches from 2415. The term "strain" is used to distinguish between the different kinds of vira—Ordinary, Tzaneen, Bulawayo, etc.

EXPERIMENT
With Mule Virus, Type 1965,
HORSE 1087 TZANEEN

Gen.	Date of Injection.	Species.	No.	VIRUS.				Reaction from.	Incub. (days)
				Inj.	Orig.	Gen.	Date.		
I	1906. June 28	Mule	1965	I. 5	1087	Orig.	1906. —	1906. July 5 to 11	7
	II Aug. 4	"	1995	"	1965	1	—	Aug. 10 to 15	6
III	" 4	"	1996	"	"	1	—	" 8 to 13	4
	" 11	"	2034	"	1996	2	Aug. 12	" 17 to 20	6
IV	Dec. 17	Horse	2479	I. 2	*,,	"	" 12	—	—
	" 17	Mules, Natal (simlt. serum)	—	—	"	"	" 12	—	—
	" 27	Horse	2084	I. 5	*,,	"	" 12	Jan. 2 to 4	6
	1907. Mar. 12	Mule	2691	I. 2	*,,	"	" 12	—	—
" 12	"	2692	I. 10	*,,	"	" 12	—	—	
" 20	"	2697	I. 5	*2034	3	—	—	—	
Jan. 9	"	2539	"	2479	3	—	—	—	

*This virus was returned from practice.

TYPE

I Generation,
II Generation,
III Generation,

Gen.	Date of Injection.	Species.	No.	VIRUS.				Reaction from.	Incub. (days)
				Inj.	Orig.	Gen.	Date.		
IV	1907. Mar. 12	Horse	2656	I. 5	2084	3	1907. Jan. 4	1907. March 23 to 29	11
	" 28	"	2712	S. 2	"	"	" 4	—	—
	April 16	—	—	I. 2	"	"	" 4	—	—
V	" 2	Mule	2731	S. 2	"	"	" 4	—	—
	Mar. 30	"	2672	"	2656	4	Mar. 26	—	—
	April 16	—	—	I. 2	"	"	" 26	—	—
	May 21	—	—	I. 20	"	"	" 26	—	—
	" 3	Mule	2758	S. 2	"	"	" 26	May 7 to 15	4
" 3	Horse	2685	"	"	"	" 26	" 10 to 15	7	
1908. April 6	Mule	3368	"	"	"	" 26	April 12 to 18	6	
" 6	Horse	3384	"	"	"	" 26	" 11 to 16	5	

No. 1.

Tzaneen strain, first generation.

(ORIGIN).

Re-action.	Incub. + R.	Result.	Tested.	VIRUS.				Result.	Remarks.
				Inj.	Orig.	Qual.	Gen.		
(days)	(days)								
6	13	Recovd.	1906. Dec. 28	2477	—	OTBLPW	—	R	
5	11	R †	—	—	—	—	—	—	
5	9	Slight R	—	—	—	—	—	—	
3	9	R †	—	—	—	—	—	—	
—	—	R ?	1907. April 16	I. 2	2268	Tzn.	1	R & D	
—	—	—	2 Sept. 2	I. 5	3063	H. Veld	2	R †	
—	—	—	—	—	—	—	—	—	
2	8	Slight R	—	—	—	—	—	—	Killed on account of debility, 9/1/07.
—	—	Irreg. R	Mar. 28	S. 2	2415	Tzn.	4	R	Continued.
—	—	"	" 28	"	1965	"	1	Atyp. R	
—	—	"	2 April 16	"	2415	"	4	R	Continued.
—	—	No R	" 4	"	2629	"	5	R †	
—	—	Atyp. R	Jan. 22	"	2415	"	4	R	Continued.

R†—Reaction and died. R?—Doubtful reaction. R & D—Reaction and dikkop.
R—Reaction.

1965.

Mule 1965.

Mule 1996.

Horse 2084.

Re-action.	Incub. + R.	Result.	Tested.	VIRUS.				Result.	Remarks.
				Inj.	Orig.	Qual.	Gen.		
(days)	(days)								
6	17	R †	1907.	—	—	—	—	—	
—	—	No R	—	—	—	—	—	—	
—	—	"	May 3	I. 2	2415	Tzn.	4	R D †	Simult. 400 c.c. serum.
—	—	"	April 16	I. 5	Natal	116/97	—	R	Continued.
—	—	"	—	—	—	—	—	—	
—	—	"	—	—	—	—	—	—	
—	—	"	—	—	—	—	—	—	
8	12	Recovd.	1 May 28	S. 2	2415	Tzn.	4	Irreg. R	
—	—	—	2 June 10	S. 8	2418	—	—	—	
—	—	—	—	—	2284	—	—	—	
—	—	—	—	—	2463	—	—	—	
—	—	—	—	—	2565	—	—	—	
—	—	—	—	—	2709	Ord.	—	—	
—	—	—	—	—	2148	Tzn.	—	—	
—	—	—	—	—	2168	Bul.	—	—	
5	12	R & D	July 16	T.9000	2876	—	—	—	
6	12	Recovd.	1908.	—	—	—	—	—	
5	10	R †	May 7	T. 2	3494	P.P.R.	1	R	

R†—Reaction and died. R & D—Reaction and dikkop. RD†—Reaction with dikkop and died. R—Reaction.

EXPERIMENT

TYPE:

 III Generation,
 IV Generation,
 V Generation,
 V Generation.

Gen.	Date of Injection.	Species.	No.	VIRUS.				Reaction from.	Incub. (days).
				Inj.	Orig.	Gen.	Date.		
VI	1908. Feb. 26	Mule	3293	S. 2	2685	5	1907. May 12	1908. March 4 to 11	7
	„ 26	Horse	3345	„	„	„	„ 12	„ 6 to 10	9
	April 23	„	3396	„	3368	„	1908. April 14	April 28 to May 3	5
	May 21	Mule	3537	„	„	„	„ 14	May 29 to June 4	8
VII	June 4	Donkey foal	3574	I. 10	3537	6	June 1	—	—
	Mar. 20	Horse	3439	S. 2	3293	6	Mar. 9	—	—
	April 11	—	—	I. 2	„	„	„ 9	—	—
	„ 23	Horse	3459	S. 2	„	„	„ 9	—	—

No. 1—(continued).

1965.

Horse 2084.
 Horse 2656.
 Horse 2685.
 Mule 3368.

Re- action.	Incub. + R.	Result.	Tested.	VIRUS.				Result.	Remarks.	
				Inj.	Orig.	Qual.	Gen.			
(days) 7	(days) 14	Recovd.	-	1908. April 6 May 7	S. 2 " "	3308 3494 3501	Simp. P.P.R. CD VI	— 1 1	No R Slight R "	
4	13	R †								
5	10	"								
6	14	Recovd.	-	June 11	S. 8	2884 3272 3501 3494	CD CD V CD VI P.P.R.	3 1 1 1	R " " "	Complicated piroplas- mosis.
—	—	Atyp. R	-	—	—	—	—	—	—	
—	—	No. R.	-	—	—	—	—	—	—	
—	—	"	-	April 23	S. 2	3248	Tzn.	6	R D †	
—	—	"	-	May 21	"	3398	"	6	"	Simult. 200 c.c. serum.

R†—Reaction and died. R—Reaction. RD†—Reaction with dikkop and died.

EXPERIMENT

TYPE

I Generation,
II Generation,
III Generation,

Gen.	Date of Injection.	Species.	No.	VIRUS.				Reaction from.	Incub (days).
				Inj.	Orig.	Gen.	Date.		
IV	1906. Dec. 21	Mule	2415	S. 10	Natal	116/97	1906. Dec. 21	Dec. 28, 1906, to Jan. 3, '07	7
	„ 27 1907.	Horse	2113	I. 10	„	116	„ 21	1907. Jan. 1 to 4	5
	Mar. 12	Mule	2690	„	„	116/97	„ 21	—	—
	„ 24 April 16	Horse Mule	2713 2731	I. „ I. 5	„	„	„ 21 „ 21	April 2 to 3 „ 22 to 30	9 6
	June 10 „ 10 July 9 1908.	„ Horse Mule	2802 2812 2891	„	„	„	„ 21 „ 21 „ 21	— June 23 to 24 July 18 to 22	— 13 9
V	Feb. 26 April 20	„ —	3284 —	S. 2 I. 10	2731	4	1907. April 25 „ 25	— —	— —
	„ 20 June 5	Horse Mule	3500 3533	S. 2 „	„	„	„ 25 „ 25	April 28 to May 5 June 10 to 20	8 5
VI	„ 5 „ 26	Horse Mule	3616 3700	„	„	„	„ 25 1908. June 16	„ 12 to 17 —	7 —

No. 1—(continued).

1965.

Mule 1965.
Mule 1996.
Mules, Natal.

Re- action.	Incub. + R.	Result.	Tested.		VIRUS.				Result.	Remarks.
					Inj.	Orig.	Qual.	Gen.		
(days) 6	13	R & D	1	1907. Feb. 5	S. 2	1938	Ord.	—	R	Simult. 50 c.c. serum. Simult. 50 c.c. serum. Simult. 100 c.c. serum. Died under infusion. 24 hours later, 100 c.c. serum.
			2	May 3	S. 6	2709 2148 2168	„ Tzn. Bul.	— — —	„ „ „	
3	8	R †								
—	—	No R	1	Mar. 28	S. 2	2415	Tzn.	4	No R	
			2	April 16	I. 2	2629	„	5	„	
			3	May 7	S. 2	2480	OTBLPW	—	„	
1	10	R D †	1	„ 21	S. 2	2480	OTBLPW	—	No R	
8	14	Recovd.	2	June 4	„	„	„	—	Atyp. R	
			3	„ 19	S. 6	2709 2148 2168	Ord. Tzn. Bul.	— — —	No R „ „	
—	—	No R	—	July 15	I. 5	2628	Ord.	—	R †	
1	14	R †								
4	13	R †								
—	—	No R	—	1908.	—	—	—	—	—	
—	—	Indef. R	1	May 7	S. 2	3500	Tzn.	5	No R	
			2	June 2	„	2884	CD	3	„	
						3272	CD V	1	„	
						3501	CD VI	1	„	
						3494	P.P.R.	1	„	
7	15	R & D	—	May 24	—	—	—	—	—	
10	15	Recovd.	—	June 26	S. 3	Poly. VI	—	—	Irreg. R	
5	12	R D †								
—	—	No R	1	July 31	S. 2	3699	Tzn.	6	R	
			2	Aug. 24	S. 3	Poly. VI	—	—	No R	

R†—Reaction and died. RD†—Reaction with dikkop and died. R—Reaction.

ANALYSIS OF RESULTS—TYPE 1965.

*Results.**“A.” Susceptibility.*

1. Of 9 subcutaneous injections into susceptible horses, 2 reacted and recovered, 4 reacted and died, 3 did not react.
2. Of 8 intrajugular injections into susceptible horses, 1 reacted and recovered, 4 reacted and died, 3 did not react.
3. Of 9 subcutaneous injections into susceptible mules, 6 reacted and recovered, 3 did not react.
4. Of 13 intrajugular injections into susceptible mules, 5 reacted and recovered, 3 reacted and died, 5 did not react.

	Subcutaneous injections.		Intrajugular injections.	
	Horses.	Mules.	Horses.	Mules.
	%	%	%	%
Reactions	66	64	62	64
Deaths	44	—	50	24
No reactions	34	33	38	36

Conclusions.

1. The susceptibility of horses and mules is about the same.
2. The subcutaneous injection of virus, type 1965, is more fatal for horses than for mules.
3. The intrajugular injection of virus, type 1965, is more fatal for horses than for mules.
4. The intrajugular injection into any animal (horse or mule) is more fatal than the subcutaneous injection.

NOTE.—The above results do not include animals which did not react to the injection and later proved to be immune.

“B.” Resistance.

Results.—Two animals which did not react to the first subcutaneous injection, nor to a second intrajugular injection, did not prove to be immune when injected with the same strain, same generation, but of a different type.

Two horses and three mules which resisted the injection of 2 or 5 c.c. virus, either intrajugularly or subcutaneously showed a horse-sickness reaction when tested with the same strain, different type, and about the same generation. Another mule reacted to the test with a different strain.

*Results.**“C.” Virulency.*

1. Of 5 susceptible horses injected with horse virus, 1 reacted and recovered, 3 reacted and died, 1 did not react.
2. Of 5 susceptible mules injected with horse virus, 4 reacted and recovered, 1 did not react.
3. Of 10 susceptible horses injected with mule virus, 2 reacted and recovered, 5 reacted and died, 3 did not react.
4. Of 15 susceptible mules injected with mule virus, 5 reacted and recovered, 3 reacted and died, 7 did not react.

Injections into.	INJECTIONS WITH					
	Horse Virus.			Mule Virus.		
	Reactions.	Died.	No Reaction.	Reactions.	Died.	No. Reaction.
Horses	80 %	60 %	20 %	70 %	50 %	30 %
Mules	100 „	20 „	nil	53 „	20 „	47 „

Conclusions.

1. Mule virus was less virulent than horse virus.
2. Horse virus caused the greatest percentage of reactions.
3. The greatest mortality was caused by the injection of horse virus into horses and mule virus into horses.
4. The least mortality was caused by (1) the injection of horse virus into mules, and (2) by mule virus into mules.

"D." Variability.

NOTE.—The subjoined and subsequent tables have been compiled with the object of showing (a) the genealogy of the vira, and (b) the percentage of reactions (R) given by the individual vira, only taking into consideration two or more injections. (M=Mule; H=Horse.)

1st Generation	...		M. 1965.
2nd Generation	...		M. 1996—40% R. (5 animals).
3rd Generation	...	H. 2084—25% R. (4 animals).	Natal M.—85% R. (7 animals).
4th Generation	...	H. 2656—100% R. (4 animals).	M. 2731—75% R. (4 animals).
5th Generation	...	H. 2685—100% R. (2 animals).	
6th Generation	...	M. 3293—Nil (3 animals).	

Conclusions.

1. The virulency of the virus varies in the different generations and depends on the injected animals.
2. It varies in the horse from 25 to 100 per cent., and in the mule from nil to 85 per cent.
3. The virus after passing through horses into a mule lost its virulency.
4. The generation had no influence on the virulency of the virus.

*"E." Influence of dose and manner of injection.**Injections of virus of type 1965.*

1. In the dose of 2 c.c. subcutaneously, 8 reacted and recovered, 3 reacted and died, 5 did not react.
Of these 5 non-reacters, 3 were tested later by subcutaneous injections of 2 c.c., 2 reacted and died, 1 reacted and recovered; and 2 were tested intrajugularly with 2 c.c. and 5 c.c. respectively, 1 reacted and died, 1 reacted and recovered.
2. In the dose of 10 c.c. subcutaneously, 1 reacted and recovered.
3. In the dose of 2 c.c. intrajugularly, 2 did not react. When tested later by intrajugular and subcutaneous injection of 2 c.c. respectively, both reacted and recovered.
4. In the dose of 5 c.c. intrajugularly, 4 reacted and recovered, 5 reacted and died, 3 did not react.
Of these 3 non-reacters, 2 were tested later by subcutaneous injections of 2 c.c., both reacted and died. One was tested with intrajugular injection of 5 c.c. (different strain) and died.
5. In the dose of 10 c.c. intrajugularly, 2 reacted and died, 1 did not react. When tested later by subcutaneous injection of 2 c.c., this animal reacted and recovered.

EXPERIMENT

With Mule Virus, Type 2415,

HORSE 1087, TZANEEN

I Generation,
II Generation,
III Generation,
IV Generation.

Gen.	Date of Injection.	Species.	No.	VIRUS.				Reaction from.	Incub. (days)
				Inj.	Orig.	Gen.	Date.		
V	1907. Jan. 22	Mule	2539	S. 2	2415	4	1907. Jan. 2	1907. Jan. 26 to Feb. 2	3
	Feb. 4	Horse	2629	"	"	"	" 2	Feb. 9 to 17	6
	" 4	Mule	2597	"	"	"	" 2	" 11 to 19	7
	" 27	"	2662	"	"	"	" 2	March 4 to 11	5
	Mar. 20	"	2669	S. 5	"	"	1906. Dec. 30	March 25 to April 1	5
	" 28	Horse	2715	S. 2	"	"	1907. Jan. 2	April 4 to 10	7
	" 28	Mule	2690	S. 2	"	"	" 2	—	—
	" 28	"	2691	"	"	"	" 2	" 4 to 10	7
	April 2	"	2732	"	"	"	" 2	—	See
	" 4	"	2694	"	"	"	" 2	—	See
	" 4	"	2696	"	"	"	" 2	" 10 to 16	6
	" 16	"	2692	"	"	"	" 2	" 22 to 29	6
	" 23	Horse	2651	"	"	"	" 2	" 28 to	5
	June 20	Donkey foal	2834	T. 5	"	"	" 2	May 4 June 24 July 13	4

No. 2.

Tzaneen strain, 4th generation.

(ORIGIN).

Mule 1965.
 Mule 1996.
 Mules, Natal.
 Mule 2415.

Re-action.	Incub. + R.	Result.	Tested.	VIRUS.				Result.	Remarks.
				Inj.	Orig.	Qual.	Gen.		
(days)	(days)		1907.						
7	10	Recovd.	1 Feb. 5	S. 2	2407	Ord.	38	Reactn.	
			2 April 16	"	2406	OTBLPW	—	"	
7	13	R †							
8	15	Recovd.	1 Feb. 26	S. 2	2598	Ord.	—	R (late)	
			2 April 17	"	2406	OTBLPW	—	No R	
7	12	"	1 Mar. 20	"	1965	Tzn.	1	Atyp. R	
			2 April 4	"	2268	"	—	No R	
			3 May 7	S. 6	2709	Ord.	—	"	
					2148	Tzn.	—	"	
					2168	Bul.	—	"	
7	12	"	4 16 April	S. 2	2406	OTBLPW	—	R	Simult. 150 c.c. serum.
			2 May 7	S. 6	2709	Ord.	—	"	
					2148	Tzn.	—	No R	
					2168	Bul.	—	"	
6	13	R †							
—	—	No R	1 April 16	I. 2	2629	Tzn.	—	"	Simult. 50 c.c. serum.
			2 May 7	S. 2	2480	OTBLPW	—	No R	Simult. 150 c.c. serum.
6	13	Recovd.	1 April 16	"	2406	"	—	Indef. R	
			2 May 7	S. 6	2709	Ord.	—	"	
					2148	Tzn.	—	No R	
					2168	Bul.	—	"	
later	—	—	—	—	—	—	—	—	
later	—	—	—	—	—	—	—	—	
6	12	Recovd.	1 April 23	S. 2	2406	OTBLPW	—	Indef. R	Simult. 100 c.c. serum.
			2 May 14	S. 5	2709	Ord.	—	"	
					2148	Tzn.	—	No R	
					2168	Bul.	—	"	
7	13	R & D	— " 21	S. 2	2480	OTBLPW	—	"	Simult. 50 c.c. serum.
6	11	R D †							
9	13	Recovd.	—	—	—	—	—	—	

R—Reaction. R†—Reaction and died. RD—Reaction with dikkop.
 RD†—Reaction, dikkop, and died.

EXPERIMENT

TYPE

IV Generation,
V Generation,
V Generation,
V Generation,

Gen.	Date of Injection.	Species.	No.	VIRUS.				Reaction from.	Incub (days)
				Inj.	Orig.	Gen.	Date.		
V	1908. Jan. 28	Mule	3227	S. 2	2415	4	1907. Jan. 2	1907. Jan. 31 to Feb. 4	3
	April 18	Horse	3465	"	"	"	1906. Dec. 29	April 26 to May 2	8
	" 18	Mule	3278	"	"	"	" 29	April 24 to 30	6
	" 20	"	3279	"	"	"	" 29	April 25 to May 1	5
	" 20	"	3285	"	"	"	" 29	April 25 to May 2	5
	" 20	"	3390	"	"	"	" 29	April 26 to May 4	6
	" 20	"	3225	—	—	—	—	—	—
	May 14 1907.	Horse	3484	S. 2	2415	4	Dec. 29 1907.	May 19 to 24	5
VI	April 4 1908.	"	2706	"	2669	5	Mar. 29 " 8	April 11 to 16 " 9 to 16	7 7
	" 2	Mule	2733	"	2662	5	" 8	" 9 to 16	7
	April 20	Horse	3499	"	"	"	" 8	" 26 to 30	6
	" 20	"	3495	"	2692	5	April 24	May 2 to 5	12

No. 2—(continued).

2415.

Mule 2415.
 Mule 2669.
 Mule 2662.
 Mule 2692.

Re- action.	Incub. + R.	Result.	Tested.		VIRUS.				Result.	Remarks.
					Inj.	Orig.	Qual.	Gen.		
(days)	(days)			1908.						
4	7	R D †								
6	14	Recovd.	1	Aug. 7	S. 2	3375	Tzn.	18	No R	Simult. 200 c.c. serum.
			2	June 19	"	3513	CD VI	2	R	
			3	July 13	T. 10000	3735	"	2	No R	
6	12	Slight R	-	May 7	S. 2 {	3494	P.P.R.	1	} R	Simult. 50 c.c. serum.
6	11	Recovd.	-	June 2	S. 8	3501	CD VI	1		
						Poly. CD	-	-	Slight R	
7	12	R & D	-	"	"	"	-	-	No R	" "
8	14	Recovd.	-	"	"	"	-	-	R	" "
—	—	R †								
5	10	R D †								
5	12	"								
7	14	R †								
4	10	R †								
3	15	R D †								

R—Reaction.

R†—Reaction and died.

RD—Reaction and dikkop.

RD†—Reaction with dikkop and died.

EXPERIMENT

TYPE

IV Generation,

Gen.	Date of Injection.	Species.	No.	VIRUS.				Reaction from.	Incub. (days)
				Inj.	Orig.	Gen.	Date.		
V	1907. April 4	Mule	2694	S. 2	2415	4	1907. Jan. 2	1907. April 9 to 18	5
VI	1908. July 15	"	3699	"	2694	5	April 11	July 20 to 31	5
VII	" 31	Horse	3745	"	3699	6	1908. July 27	Aug. 7 to 13	7
	" 31	Donkey foal	3659	S. 5	"	"	" 27	" 7 to 14	7
	" 31	"	3660	I. 5	"	"	" 27	Aug. 7 to 12	7
	" 31	Mule	3525	S. 2	"	"	" 27	" 5 to 11	5
	" 31	"	3649	"	"	"	" 27	" 5 to 15	5
	" 31	"	3652	"	"	"	" 27	Aug. 5 to 11	5
	" 31	"	3653	"	"	"	" 27	" 6 to 14	6
VIII	Aug. 14	Horse	3479	S. 3	3659	7	Aug. 11	Aug. 19 to	4
	" 14	"	3685	S. 3	3660	7	" 11	Sept. 1 —	—

No. 2—(continued).

2415.

Mule 2415.

Re- action.	Incub. + R.	Result.	Tested.		VIRUS.				Result.	Remarks.
					Inj.	Orig.	Qual.	Gen.		
(days) 9	(days) 14	R & D	1	1907. April 23	S. 2	2406	OTBLPW	—	No R	Simult. 100 c.c. serum.
			2	May 14	S. 5	{ 2709 2148 2168	{ Ord. Tzn. Bul.	{ — — —	”	
11	16	Recovd.	—	1908. Aug. 24	S. 3	Poly. VI	—	—	No R	After 24 hrs. 100 c.c. serum.
6	13	R †	—	—	—	—	—	—	—	
7	14	Recovd.	—	—	—	—	—	—	—	
5	12	”	—	—	—	—	—	—	—	
6	11	R †	—	—	—	—	—	—	—	
10	15	Recovd.	—	Aug. 24	S. 3	Poly. VI	—	—	No R	After 24 hrs. 100 c.c. serum.
6	11	R †	—	—	—	—	—	—	—	
8	14	”	—	—	—	—	—	—	—	
6	12	Recovd.	—	Aug. 24	S. 3	Poly. VI	—	—	No R	After 24 hrs. 100 c.c. serum.
14	18	R D †	—	—	—	—	—	—	—	
—	—	No R	1	Aug. 22	S. 3	3699	Tzn.	6	R & D	Simult. 300 c.c. serum.
			2	Sept. 9	”	Poly. VI	—	—	No R	” ”
			3	Oct. 14	T. 10000	3934	P.P.R.	—	”	

R & D—Reaction and dikkop. R†—Reaction and died. RD†—Reaction with dikkop and died.

EXPERIMENT

TYPE

 IV Generation,
 V Generation,
 V Generation,

Gen.	Date of Injection.	Species.	No.	VIRUS.				Reaction from.	Incub. (days)
				Inj.	Orig.	Gen.	Date.		
VI	1907. Mar. 30	Horse	2686	S. 2	2597	5	1907. Feb. 14	1907. —	—
	April 16	—	—	I. 2	..	..	.. 14	April 21 to 25	5
	1908. Feb. 26	Mule	3389	S. 2	..	..	.. 14	—	—
	April 22	—	—	I. 10	..	..	.. 14	—	—
	Mar. 20	Horse	3451	S. 2	..	..	.. 14	—	—
	April 20	..	3448	I. 10	..	..	.. 14	April 30 to May 3	10
	June 19	Mule	3567	I. 50	..	..	.. 14	June 29 to July 5	10
	1907. Mar. 20	..	2639	S. 2	2620	5	.. 14	March 28 to April 3	8
	.. 26	..	2730	I. 2	..	..	.. 14	April 4 to 9	7
	April 16	..	2690	I. 2	..	..	.. 14	—	—
	.. 4	..	2693	S. 2	..	..	.. 14	April 8 to 16	4
	.. 4	..	2695	..	..	..	.. 14	April 10 to 16	6
	.. 4	..	2697	..	..	..	.. 14	.. 8 to 13	4
	1908. April 11	Horse	3443	..	..	..	.. 14	.. 15 to 18	4

No. 2—(continued).

2415.

Mule 2415.
Mule 2597.
Horse 2629.

Re- action.	Incub. + R.	Result.	Tested.	VIRUS.				Result.	Remarks.
				Inj.	Orig.	Qual.	Gen.		
(days)	(days)		1908.						
—	—	No R	—	—	—	—	—	—	
4	9	R †	—	—	—	—	—	—	
—	—	Indef. R	—	—	—	—	—	—	
—	—	No R	1 June 3	S. 2	3361	Tzn.	7	R	
—	—		2 „ 26	S. 3	Poly.	—	—	No R	
—	—	Indef. R	1 April 20	S. 2	3398	Tzn.	6	R	
3	13	R D †	2 May 23	T.8500	3544	Simp. III	—	No R	
6	16	R †							
6	14	R & D	1 1907. April 16	S. 2	2406	OTBLPW	—	No R	Simult. 150 c.c. serum.
—	—		2 May 3	„	2418	OTB	—	„	
—	—		3 „ 21	S. 6 {	2709	Ord.	—	„	
—	—				2148	Tzn.	—		
—	—				2168	Bul.	—		
5	12	R †							
—	—	No R	1 May 7	S. 2	2480	OTBLPW	—	No R	Simult. 50 c.c. serum.
—	—		2 „ 21	S. 6 {	2709	Ord.	—	„	
—	—				2148	Tzn.	—		
—	—				2168	Bul.	—		
8	12	Recovd.	1 April 23	S. 2	2406	OTBLPW	—	Slight R	Simult. 100 c.c. serum.
—	—		2 May 14	S. 5 {	2709	Ord.	—	No R	
—	—				2148	Tzn.	—		
—	—				2168	Bul.	—		
6	12	„	1 April 24	S. 2	2406	OTBLPW	—	Slight R	„ „ „
—	—		2 May 14	S. 5 {	2709	Ord.	—	No R	
—	—				2148	Tzn.	—		
—	—				2168	Bul.	—		
5	9	R †							
3	7	Slight R	— 1908. April 27	S. 2	2891	Tzn.	4	R †	

R—Reaction. R†—Reaction and died. RD†—Reaction with dikkop and died.

EXPERIMENT

TYPE

IV Generation,
V Generation,

Gen.	Date of Injection.	Species.	No.	VIRUS.				Reaction from.	Incub.
				Inj.	Orig.	Gen.	Date.		
VI	1908. Aug. 14	Mule	3788	S. 2	2694	5	1907. April 11	1908. Aug. 18 to 29	(days) 3
	„ 24	Donkey foal	3678	S. 5	„	„	„ 11	Aug. 26 to Sept. 9	1
	„ 24	„	3677	I. 5	„	„	„ 11	Aug. 28 to Sept. 9	3
	„ 24	Horse foal	3381	S. 2	„	„	„ 11	Aug. 27 to 31	2
VII	Sept. 11	Horse	3899	S. 3	3677	6	1908. Sept. 9	Sept. 15 to 19	3
	„ 11	„	3894	„	3678	6	„ 3	„ 16 to 19	4

V Generation,
VI Generation,
VI Generation,
VI Generation,

Gen.	Date of Injection.	Species.	No.	VIRUS.				Reaction from.	Incub.
				Inj.	Orig.	Gen.	Date.		
VII	1908. April 24	Horse	3397	S. 2	3443	6	1908. April 21	Was not virulent	(days) —
	„ 27	„	3234	„	2730	6	1907. April 6	1908. May 5 to 10	8
	„ 11	„	3449	„	2639	6	„ 1	April 19 to 26	8
VIII	„ 24	„	3477	„	3449	7	1908. April 23	May 1 to 6	7

No. 2—(continued).

2415.

Mule 2415.
Mule 2694.

Re- action.	Incub. + R.	Result.	Tested.		VIRUS.				Result.	Remarks.
					Inj.	Orig.	Qual.	Gen.		
(days)	(days)			1908.						
12	15	Recovd.	-	Sept. 10	S. 3	Poly. VI	—	—	No R	Simult. 100 c.c. serum.
15	16	„	-	—	—	—	—	—		
13	16	„	-	—	—	—	—	—		
5	7	R †								
5 4	8 8	R D † R †								

Horse 2629.
Mule 2639.
Mule 2730.
Horse 3443.

Re- action.	Incub. + R.	Result.	Tested.		VIRUS.				Result.	Remarks.
					Inj.	Orig.	Qual.	Gen.		
(days)	(days)			1908.						
—	—	No R	-	May 7	I. 2	3449	Tzn.	7	R †	Simult. 300 c.c. serum.
5 7	13 15	R D † Slight R	1 2	April 27 June 19	S. 2 „	2415 3513	Tzn. CD VI	4 2	R „	
5	2	R D †								

RD†—Reaction with dikkop and died. R†—Reaction and died. R—Reaction.

EXPERIMENT

TYPE

III Generation,
IV Generation,

Gen.	Date of Injection.	Species.	No.	VIRUS.				Reaction from.	Incub. (days)
				Inj.	Orig.	Gen.	Date.		
V	1907. June 20	Donkey foal	2834	I. 5	2415	4	1907. Jan. 2	1907. June 24 to July 3	4
VI	„ 27	Horse	2827	I. 2	2834	5	June 27	July 4 to 9	7
	Aug. 17	„	2793	I. 5	„	„	„ 27	Aug. 24 to 26	7
	„ 29	Donkey foal	2564	I. 5	„	„	„ 27	—	—
	Sept. 2	Horse foal	2707	„	„	„	„ 27	Sept. 8 to 14	—
	Oct. 4	Horse	3078	I. 10	„	„	June 25, 26, 27, 29	—	—
„ 4	„	3060	„	„	„	June 25, 26, 27, 29 ; July 1	—	—	
„ 24	„	3056	S. 10	„	„	„	Nov. 4 to 10	10	

No. 2—(continued).

2415.

Mules, Natal.

Mule 2415.

Re- action.	Incub. + R.	Result.	Tested.	VIRUS.				Result.	Remarks.
				Inj.	Orig.	Qual.	Gen.		
(days) 9	(days) 13	Recovd.	-	1907.	-	-	-	-	-
5	12	R †	-	-	-	-	-	-	-
2	9	”	-	-	-	-	-	-	-
-	-	Indef. R	-	-	-	-	-	-	-
-	-	Irreg. R	-	Oct. 4	I. 5	2891	Tzn.	4	R †
-	-	No R	1	Jan. 24	I. 2	2884	CD	3	-
-	-	No R	2	Feb. 26	T.	3375	Tzn.	18	Piropl. †
-	-	No R	-	Oct. 24	S. 2	2891	Tzn.	4	R D †
7	17	R †	-	-	-	-	-	-	Simult. 300 c.c. serum.

R†—Reaction and died. Piropl.†—Died of piroplasmosis.

RD†—Reaction with dikkop and died.

ANALYSIS OF RESULTS—TYPE 2415.

“A.” *Susceptibility.**Results.*

1. Of 21 subcutaneous injections into susceptible horses, 2 reacted and recovered, 15 reacted and died, 4 did not react.
2. Of 6 intrajugular injections into susceptible horses, 4 reacted and died, 2 did not react.
3. Of 30 subcutaneous injections into susceptible mules, 21 reacted and recovered, 8 reacted and died, 1 did not react.
4. Of 2 intrajugular injections into susceptible mules, 1 reacted and died, 1 did not react.

Taking these figures out according to percentages,

	Reactions.	Deaths.	No Reaction.
	%	%	%
Subcutaneous injections into horses caused	81	61	20
” ” ” mules	96	27	3
Intrajugular ” ” horses	66	66	33
” ” ” mules	Not sufficient numbers.		

Conclusions.

1. The susceptibility of mules is greater than that of horses.
2. The mortality is greater in horses than in mules.
3. The mortality in horses is greater after an intrajugular injection than after a subcutaneous injection.

“B.” *Resistance.*

1. A mule which did not react to the subcutaneous or intrajugular injection of virus, type 2415, contracted the disease later when subjected to the same type of the succeeding generation.

2. Of four horses which did not react to a subcutaneous or an intrajugular injection, two died when tested with the previous generation of the same or different type, and one reacted; one animal tested with the following generation of a different type reacted.

3. One horse which resisted the first subcutaneous injection contracted the disease and died when injected with the same dose of the same virus intrajugularly.

4. One mule which resisted (1) a subcutaneous injection and (2) an intrajugular injection proved to be susceptible to the subcutaneous injection of 2 c.c. virus of the same strain, different generation.

“C.” *Virulency.**Results.*

1. Of 2 susceptible horses injected with horse virus, 1 reacted and died, 1 did not react.
2. Of 16 susceptible mules injected with horse virus, 3 reacted and recovered, 2 reacted and died, 1 did not react.
3. Of 15 susceptible horses injected with mule virus, 2 reacted and recovered, 12 reacted and died, 1 did not react.
4. Of 27 susceptible mules injected with mule virus, 18 reacted and recovered, 7 reacted and died, 2 did not react.
5. Of 10 susceptible horses injected with donkey foal virus, 6 reacted and died, 4 did not react.

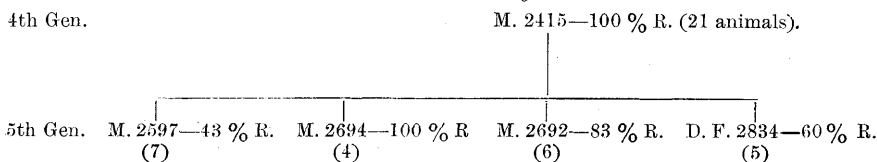
Taking these figures out according to percentages,

	Reactions.	Deaths.	No Reaction.
	%	%	%
The injection of horses with horse virus caused	—	—	—
„ mules „ „ „	83	33	16
„ horses „ mule virus caused	93	73	7
„ mules „ „ „	96	24	4
„ horses „ donkey foal virus			
caused	60	60	40

Conclusions.

1. Mule virus caused the greatest percentage of reactions in mules.
2. Mule virus injected into horses caused the greatest mortality.
3. The least mortality is caused by the injection of mule virus into mules.
4. Horses show the least susceptibility to donkey virus.
5. Horse virus caused a greater percentage of mortality when injected into mules than that caused by mule virus.
6. Horse virus failed to produce reactions in mules to a greater extent than mule virus.

“D.” Variability.



Conclusions.

1. The mule virus of fourth generation proved to be virulent for 100 per cent. of susceptible animals.
2. In the succeeding generation, the virulency of the virus varied from 43 to 100 per cent.
3. The generation had no influence on the virulency of the virus.

“E.” Influence of dose and manner of injection.

Injections of virus of type 2415.

1. In the dose of 2 c.c. subcutaneously, 25 reacted and recovered, 16 reacted and died, 5 did not react.
Of these 5 non-reacters, when tested later by subcutaneous injection of 2 c.c., 2 reacted and recovered, 3 reacted and died.
2. In the dose of 3 c.c. subcutaneously, 3 reacted and died, 1 did not react.
When tested later by a subcutaneous injection of 2 c.c., this animal reacted and recovered.
3. In the dose of 5 c.c. subcutaneously, 1 reacted and recovered.
4. In the dose of 10 c.c. subcutaneously, 1 reacted and died.
5. In the dose of 2 c.c. intrajugularly, 1 reacted and died.
6. In the dose of 5 c.c. intrajugularly, 1 reacted and died, 1 did not react.
When tested later by intrajugular injection of 5 c.c., this animal died.
7. In the dose of 10 c.c. intrajugularly, 1 reacted and died, 1 did not react.
When tested later by intrajugular injection of 2 c.c., this animal died.
8. In the dose of 50 c.c. intrajugularly, 1 animal reacted and died.