January 23, 1952

[redacted]

[redacted]

This is to thank you for the serum specimens from yourself and [redacted] which arrived in excellent condition this morning. I am most grateful to both of you for this kindness.

In reply to your request for the nonparalytic strain of polio virus which I used in my experiments on the effect of cortisone in monkeys, I should like to say that I used three different strains. However, the best results were obtained with the Vaughan strain of which I have enough to send you an adequate sample for any test that you may care to carry out. I should like to point out, to begin with, that all of the three strains produced paralytic polio as well as nonparalytic polio in different monkeys. The main point about the Vaughan strain is that a considerable proportion of the inoculated animals developed the nonparalytic variety of the infection, as indicated in the accompanying table. All the tests carried out with this strain are shown and summarized in this table. You will note that the chief function of the cortisone was to convert the nonparalytic infections into paralytic ones. Coincidentally, the incubation periods were also, in general, shorter and the severity of the paralysis much greater. In a group of 50 monkeys used in simultaneous tests with the three different strains, 25 of which were untreated and 25 of which received cortisone, the results were as follows:

	Untreated	Cortisone
Paralytic	36%	76%
Nonparalytic	28%	0
No polio	36%	24%

You will note that these results are essentially similar to those obtained with the Vaughan strain shown in the accompanying table. I don't know whether or not you are interested in the cortisone dosage we

used, but I will give it to you here to save you the trouble of writing for it in case you should be interested. The monkeys weighed very close to 2 kilos. They received 25 mg. of cortisone (1 cc) intramuscularly into the leg or thigh muscles once a day beginning with the day before inoculation of virus and continuing until paralysis appeared or a total of 12 doses had been administered, whichever was achieved first.

I am sending you by air express in a special container a vial containing approximately 10 cc of the Vaughan virus which was used in the experiments shown in the accompanying table. This is a 20% suspension of the spinal cords of 2 monkeys in saline which has been kept in dry ice since its preparation. The particular vial which I am sending you has never been thawed before. However, I can tell you that repeated freezing and thawing of such preparations has not altered the titer or behavior of a number of different strains that I have tested over a period of 3 years. I would strongly advise you to use the material in this ampule for any test that you may contemplate because it is not at all improbable that one more passage in monkeys may alter its behavior.

Please let me know if there is any additional information you would like to have about this strain. Just for the sake of completeness, I may say that it was recovered from a patient with nonparalytic polio in Cincinnati in 1947 and that it had been typed in the typing program as a Type 1 polio virus (Brunhilde).

I would appreciate it very much if you could return the stainless steel vacuum bottle and the special wooden box in which the specimen is being sent you as soon as possible.

With kindest personal regards and all good wishes,

Sincerely yours,

ABS/maj [redacted]

Tests with Vaughan Strain of Poliomyelitis Virus

Gen II of 3-9-48 supplied to Dr. [redacted]

Date of Test	Dilution of virus 0.5 ml.	Untreated Monkeys	Cortisone Monkeys
5-14-48	10^{-2}	20*, NP**, 0	....
	10^{-3}	0, 0, 0	....
	10^{-4}	0, 0, 0	....
	10^{-5}	0, 0, 0	....
6-18-51	10^{-2}	25, NP, NP, 0, 0	10, 11, 13, 0, 0
7-25-51	10^{-2}	15, NP, NP, 00	7, 8, 9, 10, 11
	10^{-3}	8, 13, NP, 0, 0	10, 16, 23, 0, 0
All tests	10^{-2}	3 - paralytic 5 - nonparalytic 5 - no polio	8 - paralytic 0 - nonparalytic 2 - no polio
	10^{-3}	2 - paralytic 1 - nonparalytic 5 - no polio	3 - paralytic 0 - nonparalytic 2 - no polio
	$10^{-2} + 10^{-3}$	21 monkeys 24% paralytic 29% nonparalytic 48% no polio	15 monkeys 73% paralytic 0% nonparalytic 27% no polio

*20 = monkey developed paralysis 20 days after inoculation. (intracerebral)
**NP = no clinical evidence of paralysis; typical polio lesions in spinal cord and medulla found 28 to 30 days after inoculation.

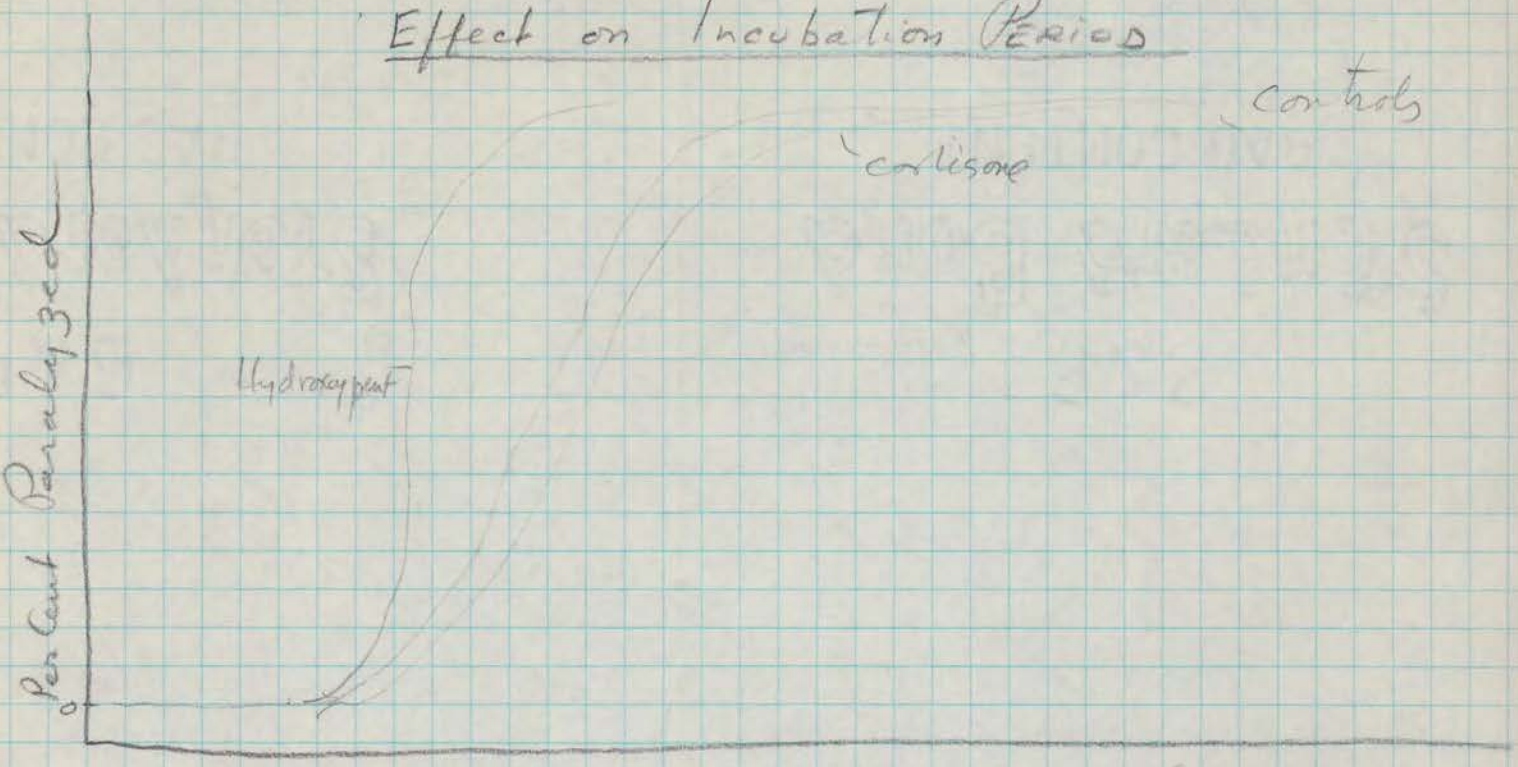
Tests with Vaughn Strain of Poliomyelitis Virus

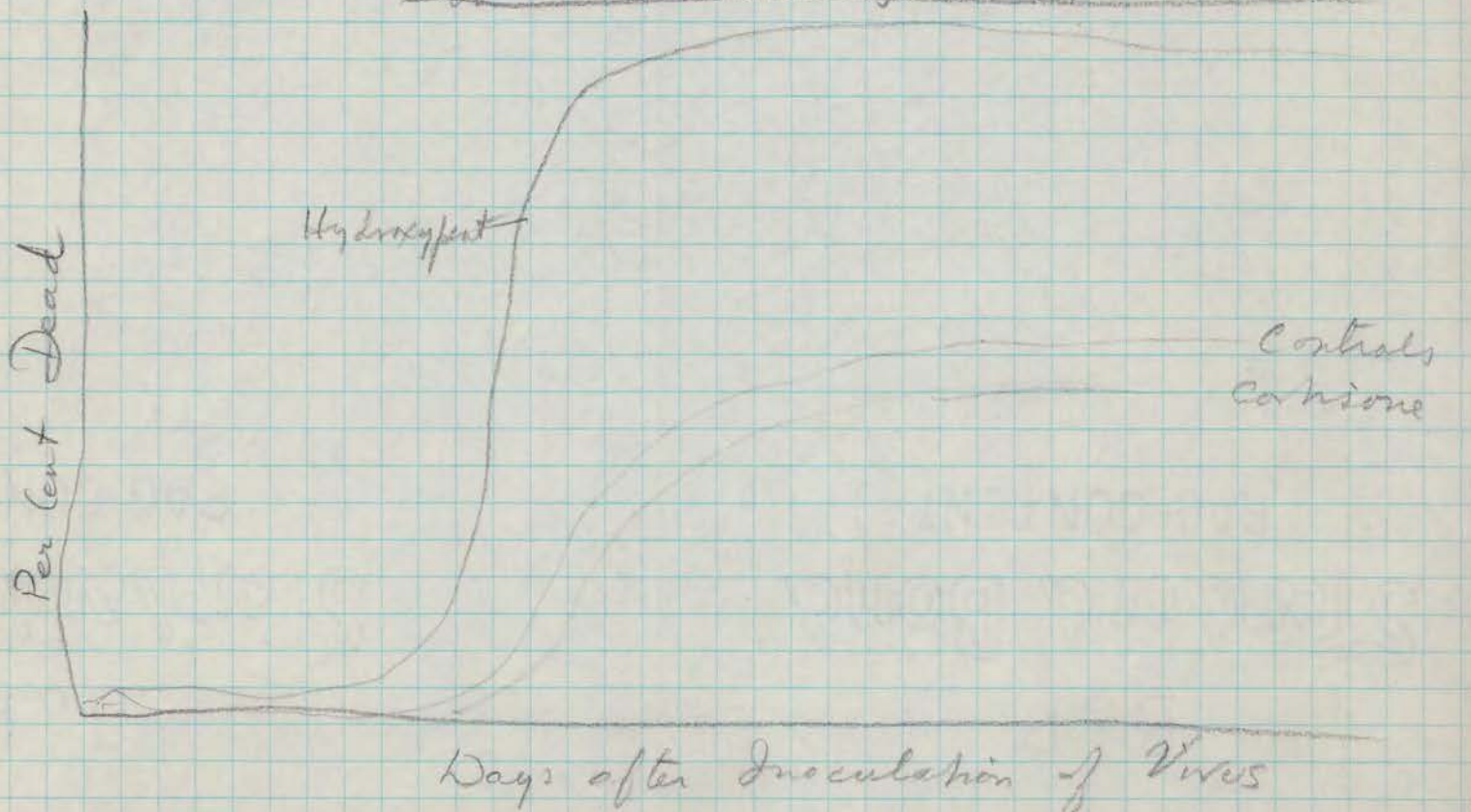
Gen II of 3-9-48

Date of Test	Dilution of virus 0.5 ml.	Untreated Monkeys	Cortisone Monkeys
5-14-48	10^{-2}	20*, NP**, 0	....
	10^{-3}	0, 0, 0	....
	10^{-4}	0, 0, 0	....
	10^{-5}	0, 0, 0	....
6-18-51	10^{-2}	25, NP, NP, 0, 0	10, 11, 13, 0, 0
7-25-51	10^{-2}	15, NP, NP, 0, 0	7,8, 9, 10, 11
	10^{-3}	8, 13, NP, 0, 0	10, 16, 23, 0, 0
All tests	10^{-2}	3 - paralytic 5 - nonparalytic 5 - no polio	8 - paralytic 0 - nonparalytic 2 - no polio
	10^{-3}	2 - paralytic 1 - nonparalytic 5 - no polio	3 - paralytic 0 - nonparalytic 2 - no polio
	$10^{-2} + 10^{-3}$	21 monkeys 24% paralytic 29% nonparalytic 48% no polio	15 monkeys 73% paralytic 0% nonparalytic 27% no polio

*20 = monkey developed paralysis 20 days after inoculation (intracerebral)
**NP= no clinical evidence of paralysis; typical polio lesions in spinal cord and medulla found 28 to 30 days after inoculation.

Comparative Effect of 6-Hydroxypentaquine and Cortisone on Experimental Poliomyelitis in Rhesus Monkeys Produced by a Virulent Strain of Virus





Method of Scoring Severity of Paralysis in Surviving

Part affected	Score: Slight or transit. 0.5	Partial 1	Very severe or complete 2
Right upper			
Left upper			
Right lower			
Left lower			
Back and/or Cran.			

Maximum score = 10
Minimum score = 0.5

Vaughan Virus

10^{-2} Untreated 20, NP, 0; NP,

		P	NP	None
Untreated	21	5	6	10
Cortisone	15	11	0	4

Par	Inv.	Type of Paralysis	Death

100 | 34
68 | 2.9.4
320
306
140

130 | 34
280 | 38

110 | 34
102 | 32.
80
120

	Total Rhesus	~~No~~ H	NP	O Strain
Untreated	34	11 (32%)	10	13
Cortisone	25	19	0	6

Untr.	25	36% (9)	28% 7	36% 9
Tr.	25	(19) 76%	0	6 24%

			5-14-48	6-8-51	7-25-51	TOTAL P	TOTAL NP	TOTAL P+NP
Vaughan	10^{-2}	Untreated	20, NP, 0	25, NP, NP, 0, 0	15, NP, NP, 0, 0	3/13	5/13	8/13
		Cortisone	- - - - -	10, 11, 13, 0, 0	7, 8, 9, 10, 11	8/10	0/10	8/10
	10^{-3}	Untreated	0, 0, 0	- - - - - -	8, 13, NP, 0, 0	2/8	1/8	3/8
		Cortisone	- - - -	- - - - -	10, 16, 23, 0 0	3/5	0/5	3/5
Petty	10^{-2}	Untreated	11, NP, NP	17, 19, 19, NP, 0		4/8	3/8	7/8
		Cortisone	- - - -	10, 10, 13, 14, 14		5/5	0/5	5/5
Hopping	10^{-1}	Untreated	- - - - -	10, 13, NP, 0, 0		2/5	1/5	3/5
		Cortisone		10, 11, 17, 0, 0		3/5	0/5	3/5

Effect of Cortisone on Hoferkamp Virus in Rhesus Monkeys.

Group	Rhesus No.	Incubation period	Extent of paralysis	Days	Outcome	Remarks
	2209	- - - -	None		Killed 28 days	No Polioencephalitis
	2210	5	Comp. par. extr. + back	10	S	
Untreated	2211	9	" " " "	10	S	
Controls	2212	10	RL, LL, Part. R.U.	5	S	
	2213	13	Part. RL + LL	2	S	
7-15-51	2214	- - -	None		Killed 28 days	No Polio les.
	2215	7	RL, LL, Back, part RU+LU	8	S	
	2216	7	Comp. par. extr. + back	10	S	
	2217	9	Ext. par. extr. + back	10	Partial recovery of uppers	
	2218	~~28~~	Comp. par. extr. + back	10	S	
		8.5				
	2219	8	Comp. par extr. + back	10	S	
Cortisone	2220	6	" " " " "	10	Dead 10	4
	2221	12	Part. par. RL + LL	2	S	
7-15-51	2222	6	RL, LL, Back, + part. uppers	8	S	
	2223	5	Comp. par. extr. + back	10	Dead 13	8
	2224	7	" " " "	10	" 9	2
	2225	8	" " " "	10	S	
	2226	9	" " " "	10	S	
	2227	8	" " " "	10	Dead 20	12
	2228	9	" " " "	10	S	
		7.8				
	2441	8	Comp. par. extr. + back	10	S	
Untreated	2442	7	" " " "	10	Dead 11	
	2443	10	" " " "	10	" 20	
11-8-51	2444	11	LU + part RL, LL, + RU.	5	S	
	2445	6	Comp. par. extr. + back	10	Dead 16	
Same dose	2446	6	" " " "	10	" 14	
of virus	2447	8	RL, LL, + part. uppers	6	S	
from same	2448	6	Comp. par. extr. + back	10	S	
ampule	2449	10	" " " "	10	S	
	2450	8	" " " "	10	Dead 17	
		8.0				

26 (4) / 2 6.)

Monkey	Par	D	Interval between P + D
1	5	13	8
2	6	10	4
3	6	5	–
4	7	9	2
5	8	20	12
6	8	5	–
7	8	5	–
8	9	5	
9	9	5	
10	12	5	
	10/10	4/10	

Days after Virus	Paralyzed			Mortality		
	No.	%	Cumul. %	No	%	Cum %
4	0	0	0	–		
5	1	10	10	–		
6	2	20	30	–		
7	1	10	40	–		
8	3	30	70	–		
9	2	20	90	1	10	10
10	–	–	90	1	10	20
11	–	–	90	–	–	–
12	1	10	100	–	–	–
13				1	10	30
14						
15						
16						
17						
18						
19						
20				1	10	40

Histology available on:

Strain	Rhes. No.	Result	No. of days after cortisone (last dose)	Inflammatory Reaction
Hoferkamp	2220	P_6 D_{10}	3	Very little or no neurono... " " " " interstitial or pvi
	2223	P_5 D_{13}	7	Slight at some levels none in others - neurons gone
	2227	P_8 D 20	12	Slight in some levels lacking in others. neurones gone
Vaughan	2057	P_{25} K 28	No cortisone	
	2058	P_{13} K_{28}	18	Moderate
	2060	P_{10} K28	18	Moderate
	2061	P_{11} K28	18	Moderate
	2231	P_{15} K_{29}	No cortisone	Marked
*	2234	D_{11}	1	Neuronophagia - slight no interst. or pvi
	2235	P_{10} K_{29}	19	Mild to moderate
	2237	P_{11} K28	17	" " "
	2238	P_9 K_{28}	17	Moderate
	2239	P_8 K_{28}	No cortisone	
	2243	P_{13} K_{28}	" "	
	2245	P_{23} K_{28}	15	Slight
	2246	P_{16} K_{28}	15	Moderate
Petty	x 2043	P_{19} D_{26}	No cortisone	Usual inflamm...
	2045	P_{19} K_{28}	" "	Moderate
	2046	P_{17} K_{28}	" "	Moderate
	2048	P_{14} K_{28}	18	Moderate
	2049	P_{14} K_{28}	18	Slight
	2050	P_{10} K_{28}	18	Extensive
	2051	P_{10} K_{28}	18	Slight
	2052	P_{13} K_{28}	18	Moderate
Hopping	2035	P_{10} K_{28}	No cortisone	Extensive
	2037	P_{13} K_{28}	" "	Moderate
	2038	P_{10} D_{14}	5	Negligible to absent
	2039	P_{17} K28	18	Slight to moderate
	2042	P_{11} K28	18	Moderate

STANDARD B & P "NOTEAR"

STANDARD B & P "NOTEAR"

Histological Observations on Rhesus Monkeys with Hofenkamp Virus and No Cortisone

(Original monkeys in 1948)

Rh 181 – Died 3 days after onset of par. – active neuronophagia + interstitial infiltr.

Rh. 160 – Died 5 days after " " " – Neurones "all gone" i.e. removed — much interstitial infiltration

Rh 145 – Died 7 days " " " – Altmost all neurons gone – no inflammatory reaction – one pri seen

Rh 175 – Died 7 days " " " – Practically no inflammatory reaction All neurones "gone"

Rh 161 – Killed 2nd day of paral. – active neuronophagia – very little inflammatory reaction; some pri

R 162 – " 3rd " " – active neuronophagia, interstitial and meningeal infiltration

R 163 – " 4th " " → slight interstitial and meningeal infiltration

Photograph

Rh 181 – Dead 3 days after par. – no cortisone

No. 1 ×100
No. 2 ×650

Show extensive neuronophagia in lumbar cord ✱ – ant. horn.

Rh. 2220 – Dead 4 days after par. + 3 days after last dose of cortisone (225 mg total)

No. 3 × 650
No. 4 × 100

Show acute necrosis of ant. horn cells with little or no neuronophagia

Rh 175 – Dead 7 days after onset of par – no cortisone

No 175 = No. 5 × 75

Show "ant. horn cells" removed + disintegrating ant. horn — little inflammatory reaction

No 2223 = No. 6 × 60

Rh 2223 – Dead 8 days after par. – 7 days after last dose of cort. (200 mg)

Removal of ANC + kidney