

COMPUTATION BOOK

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Course Arg. Holter - P.100 AVAP Heart

9 Mar. 1996



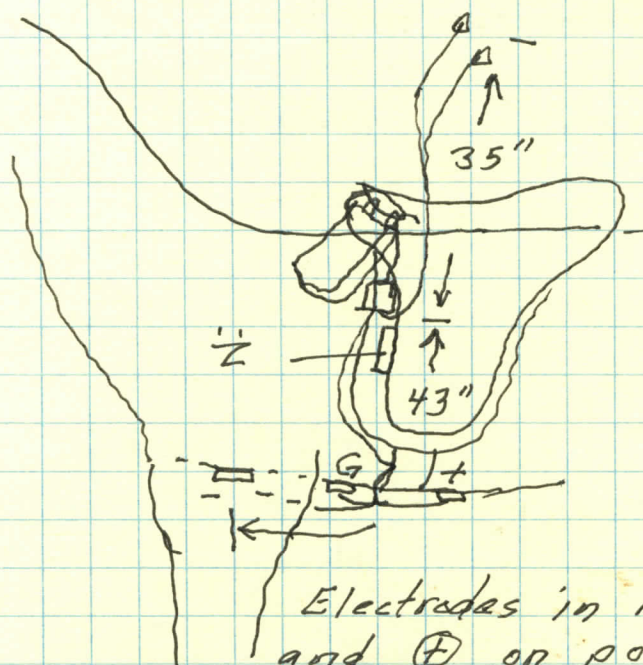
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Page Index

2- Augmented Halter, Ambul. Locomotor Monitoring
49 Overground, Treadmill Locomotion, Exercise

9 Mar. Attachment to Jen + Dawna



Flail $\bar{c}$ too short
electrode leads + had
to strip, twist + tape
gnd. + $\bar{c}$'s.

35
43

Electrodes in midline - $\ominus$ between forelegs
and $\oplus$ on post. end of sternum - gnd.
midway between. $\bar{Z}$ taped to saddle $\bar{c}$
 $\approx 10^\circ$ tilt. Problems $\bar{c}$ hookup + had to cut + splice
electrode leads.

Ch - 1 Jen $\bar{c}$ T lead
2 Dawna as above
3 $\bar{Z}$

As expected electrode site between legs was not mechanically stable

9 Mar. Simul. Monitoring Horse + Rider c Z & EKG.

Time Tape / G which has 2 sessions on it (WT-Lyon)
S? Maxell XL 115 tape - V. Cold.

~ 1000 Hooked up - Downer.

02 J off.

1010 Start lunging

413 Batt in Z & Jen on

2 trot

14 walk

3 stand

15 " in field

4 trot

16 Trot " "

7 gallop

18 Gallop " "

8 trot

19 Jen ~~off~~ sit

21 stop

22 " off

2 trot

25 lead, walk

5 stop

" trot

31 Jen on

30 stand walk

2 walk

35 off animal

1038
+1214
2252

Horse electrodes (2 anterior) 440

OFF

replaced - walk

40 trot

gallop, walk

5 ~~walk~~ trot

6 gallop - stand

7 walk, trot

8 stand

~ 1054 Jen off

~ 1100 1+2 g cal- OFF

Domin.

329 Start

346 Jen + Conn -

347 stand

8 walk

50 Trot

1 Gallop

53 Buck

various

56 Buck

7 stand

8 walk

401 stand

4 walk

7 Trot

No Batt.
in Z

2145

1900

145 AT

2216

1002

1214 A

26 Mar '96 ALM ; Isaiah Proj. (Iskay) 7 May '96

4-5 days Ordered 2 AD524 AD-Newark (Debbie) 894-9334

5 Apr Rcvd. above ordered spec. sheet from Analog Devices, Inc
617 364 1240

5 May '96 J. Iskay spent 'yesterday here where we explored various of his studies -

J.I. is v. bright knows bial. & esp. insects & particularly hornets v. well. He does descriptive studies incl. light & electron microscopy but doesn't know physics & can't do many mechanical & other experiments. He has described unique structures in insects including -

- Complex organ like structure of hornet head & movable probes (antenna), a regular series of fibres of varying length which are innervated in a cavity & varying quans. of hemolymph.
- A series of open pores & an apparent sensory cell at their bases which are connected by a nervous net.
- Various electrical phenomena assoc. & abdominal cuticle, alive or dead.

We agreed to collaborate on papers describing function & hypothesis - He will provide requested info. as possible (He has no facilities for studies I need). I promised.

- A letter outlining above
- A description of several aspects of the paper
- A list of needed information -

Resonance Data; Iskay left; a photo of Lissajous Figures ①

② Diagram of hornet electrodes

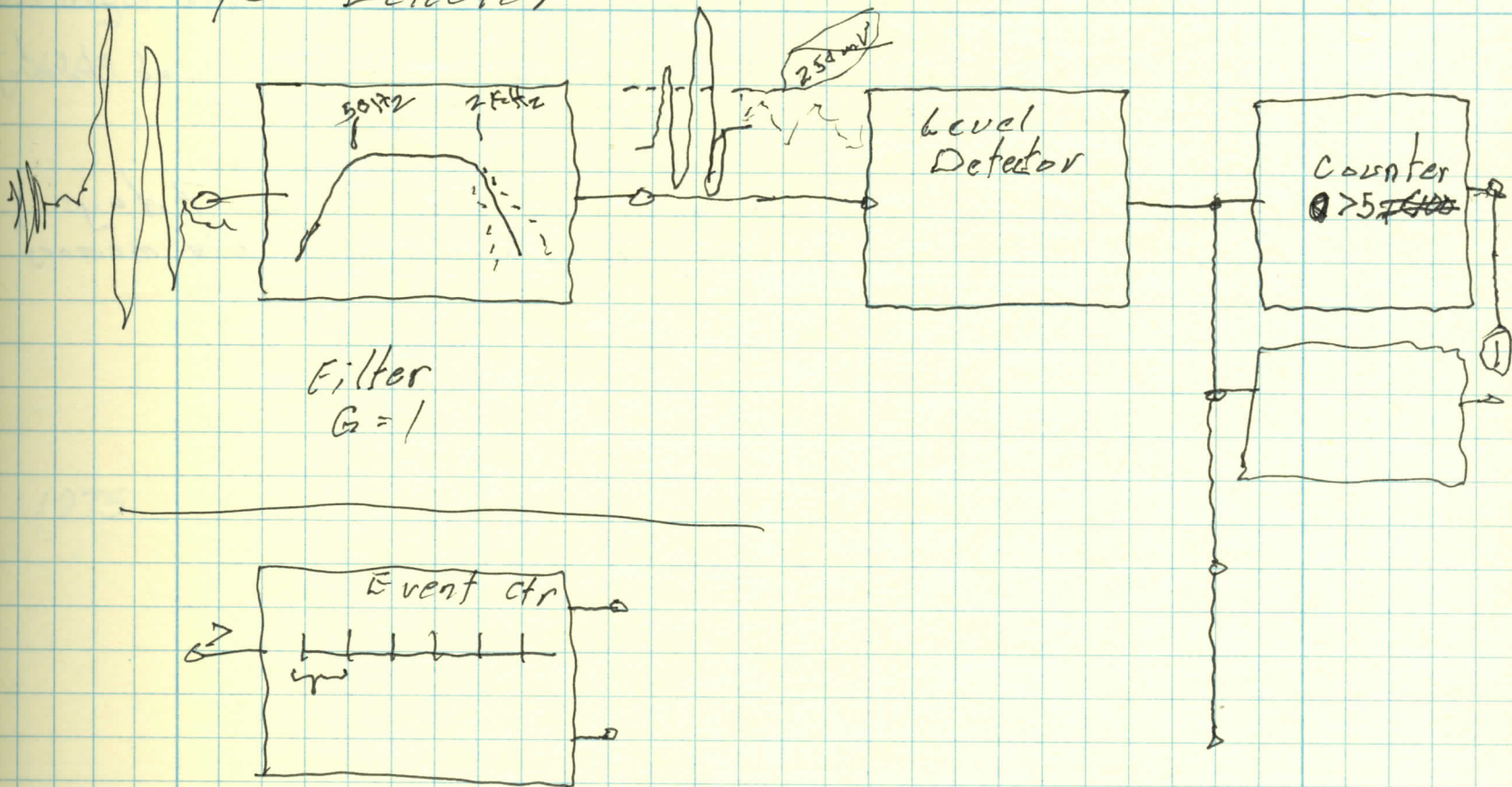
③ A pg. of data & columns of:

Temp °C	? electrode #	Freq. Hz	R(tg4)
------------	------------------	-------------	--------

④ 5 pgs containing data columns of:

Temp °C	Electrode Config.	± 2 (Freq)	± 1 (Freq)	Fr (Freq)	± r
------------	----------------------	---------------	---------------	--------------	-----

B/S Detector



12 May - Shean O'Leary - Worked for G. Pantalos - MA in E.E.

775 E. Simpson Ave. Knows hardware & S.W. - Job hunting.

SLC UT 84106 In SLC For 3 yrs -

A 801 466 2449

Briefly outlined need for recording $\ddot{z}$ + HR for 7 days
for ALM $\bar{c}$ computer analysis - Promised to find memory
cards + $\ddot{z}$. He will also look -

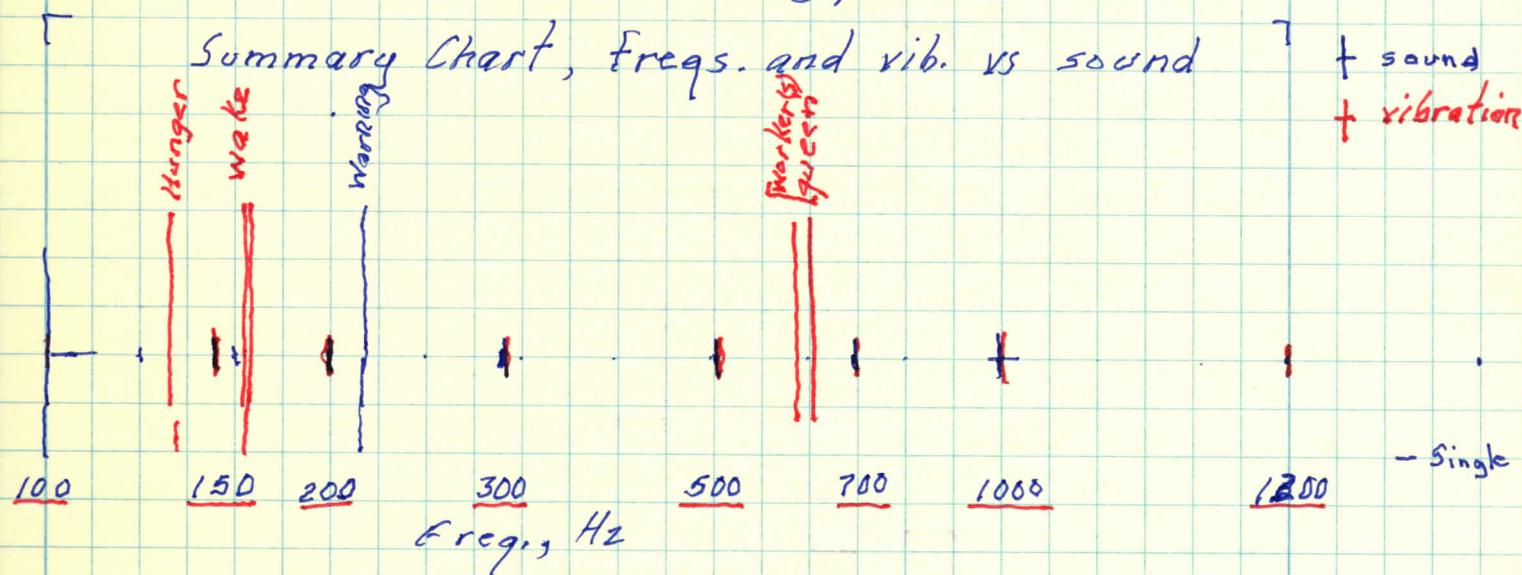
31 May Review of Hornet sounds as publ. by Ishay -

1968 J. Acous Soc Amer. 44; 1290-1301, '68
Bees respond to 'solid' (borne) vs air (borne) sounds
Hornets produce air sounds (Ishay '65)

In a sound chamber solid sounds were produced by larvae dragging mandibles across fabrication irregularities of comb. Older wasps respond to this vibration but not sound (air). Center freq. was 638 Hz. Wing noise during ventilation is ~ 163 Hz.

1975 J. Insect Physiol 21; 1737-40, '75

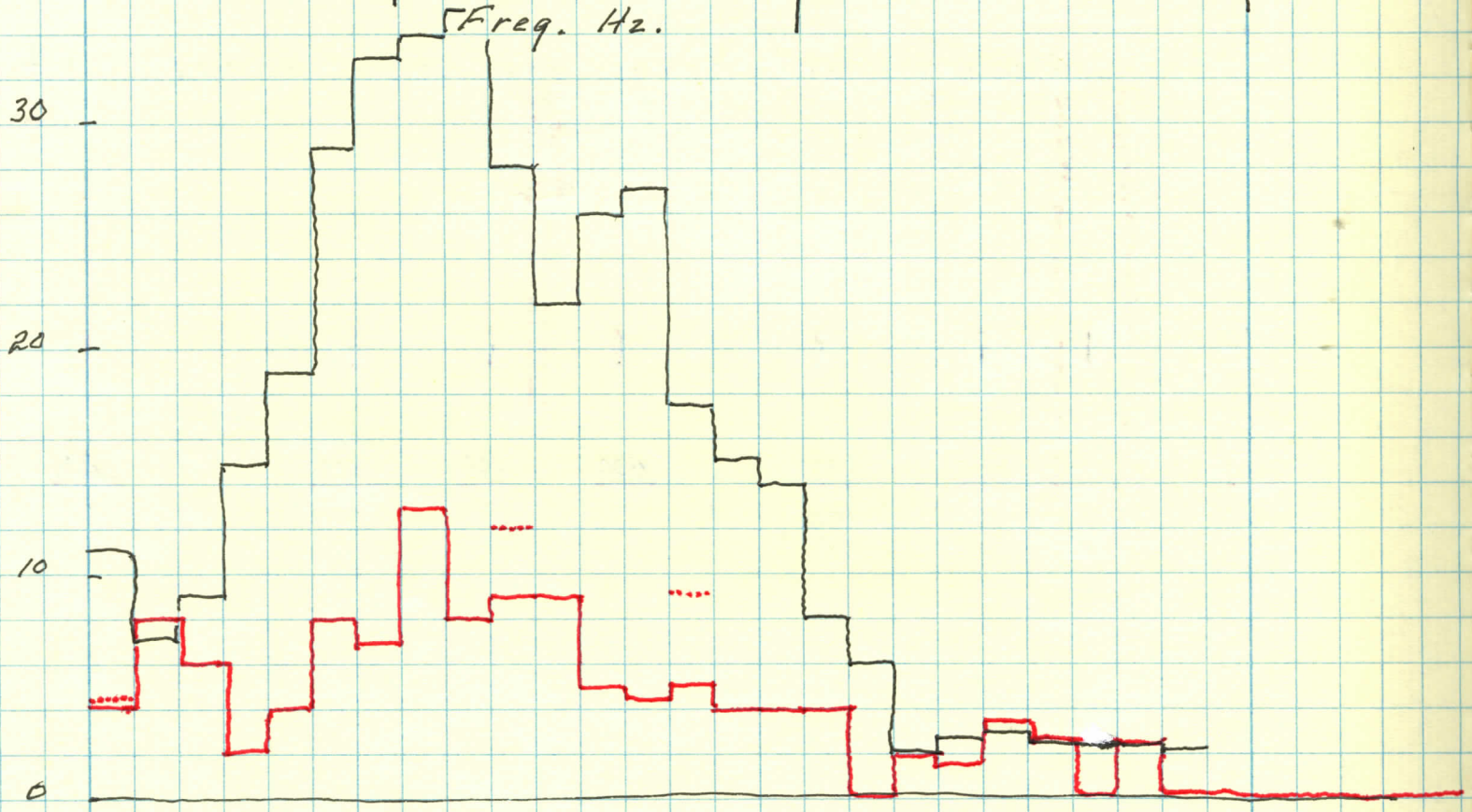
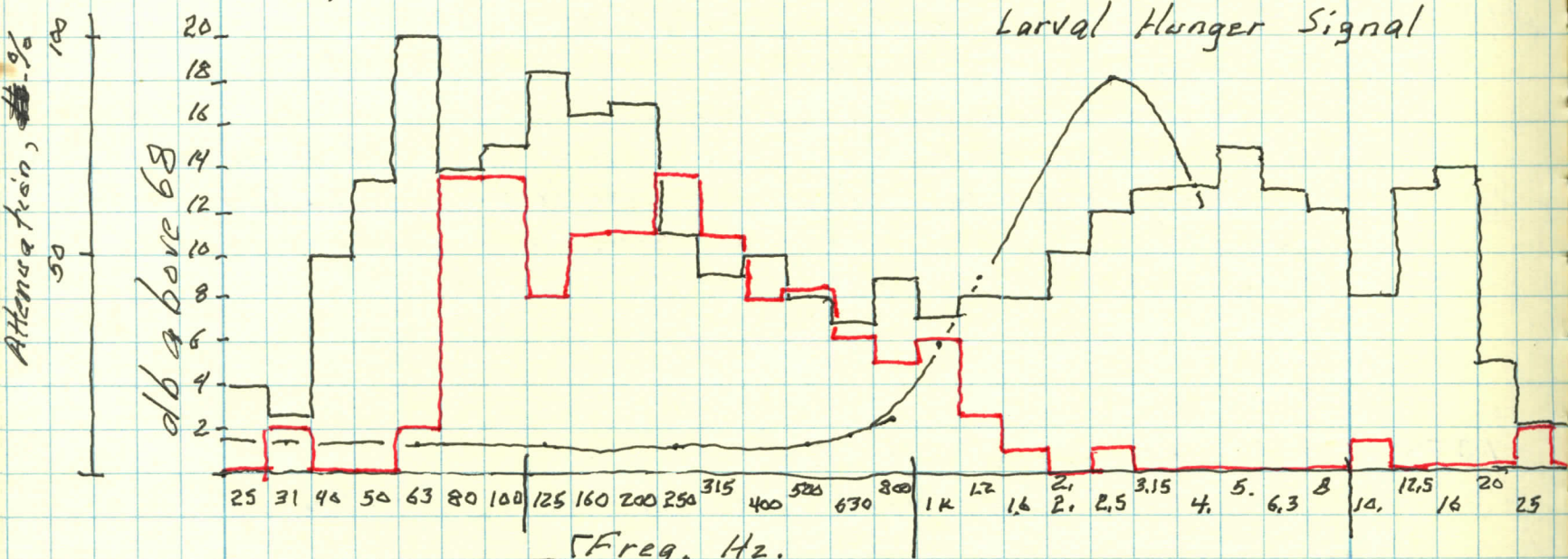
3 vibs - Larval, workers facing queen, awakening



Wasp Sounds.

Iskay. J. Insect Physiol. '75

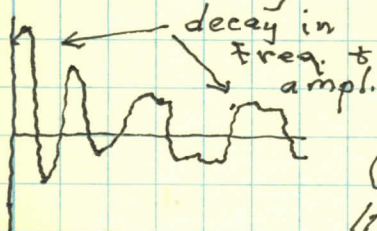
Larval Hunger Signal



Wasp Sounds - Comment

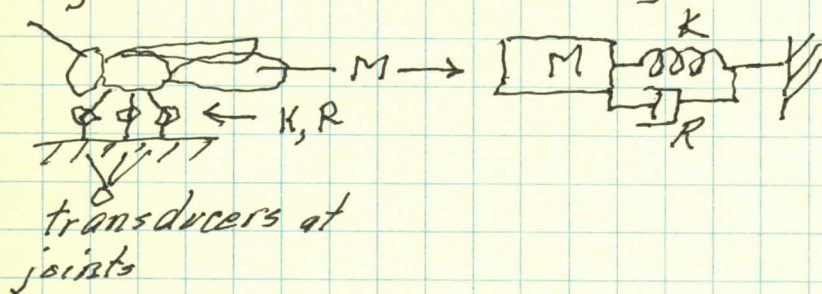
7.6.96

Ishay has described sound ("air borne") and vibrations ("solid borne") in V. Orient. Initially he claimed differences in frequency domain characteristics (Pg. 11) but later began to do time domain studies, which do not support discrete freqs. Plots of time averaged (?) spectra (opp. pg) also do not support a freq. signature of signals. While sound mics. show relatively coherent freqs, they also a complex freq. structure.



When the pulse or event repetition freq. was studied⁴ The question at hand is to discover the function of an apparently vibration sensitive resonant struct. (Frons plate) which is mechanically coupled to antennae.

It contains a series of strings of varying length & size which are heavily innervated however because of their size they must be resonant at much higher freqs. For this reason another vibration sensitive transducer ^{may} must be present for lower freqs. This could be a limb (leg) body combination where the body mass is a counterpoise and in combination with the legs might become a resonant system with a significant Q.



There may be some simple ways of detecting this.

1. Ishay terminology
2. It is difficult
3. J Acoust Soc Am 72:671-5, 1982
4. ibid 84: 841-6, 1988 there were clearly marked differences in the various signals.
5. For the moment I'm ignoring sound.

Treadmill Locomotion 23 Mar 1996

Subj. Wt. 49

Quinton TM #7699, 7701

Also see N.B. "P-131 1994 Exercise"

Time	Revs	Calc	Error	Grade	FT/sec	ΔT	HR	Wt	ΔHR	Mode
Mph	Secs.	Mph	Mph	%		min.	BPM	lbs	BPM	W/J
5.0	14.85	5.23	0.23	0	0	0	101	0 TM-699	-	
5.0	15.26	5.10	0.10	0	0			0 TM-701	-	
5.0	15.59	4.99	-0.01	0	0	3:00	103	200	114.2'	-
5.0	15.34	5.08	+0.08	3	0.22	3:	114	200	belt	11
5.0	15.41			0	0	-	-	0	for	-
5.0	-	4.99	-0.01	0	0	3:-	104	200	10 revs.	-
5.0	15.31	5.09	0.09	6	.448	3:	128	200		24
5.0	14.94	5.21	0.21	0	-	-	-	0		-
5.0	15.48	5.03	0.03	0	-	3:00	105	200		-
5.0	15.35	5.07	0.07	9	.670	3:00	141	200		36
4.5	16.75	4.65	0.15	0	-	-	-	0		-
4.5	17.02*	4.57	0.07	0	-	-	100	200		-
4.5	16.99	4.58	0.08	3	.202	3:00	111	200		11
4.5	16.72	4.66	0.16	0	-	-	-	0		-
4.5	17.02	4.57	0.07	0	-	3:00	100	200		-
4.5	17.04	4.57	0.07	6	.402	3:-	122	200		22
4.5	16.81	4.63	0.13	0	-	-	-	0		-
4.5	17.11	4.55	0.05	0	0	3:00	101	200		-
4.5	16.93	4.56	0.06	12	.809	2:36	145	200		44
4.5	16.71	4.66	0.16	0	-	-	100	0		-
4.5	17.14	4.54	0.04	0	0	3:00	100	200		-
4.5	16.46	4.73	.23	9	.624	3:00	137	200		37
6.0	-	-	-	0	0	3:00	116	200		-
6.0	-	-	-	3	.264	3:00	133	200		17
Continued 25 th Mar. TM 0681 10 Belt revs = 113.75										
4.5	17.05	4.58	.08	0	-	-	-	0		
	17.37	4.46	-.04	0	0	3:00	90	200		W
	17.41	4.46	-.04	0	0		99			J
	17.43	4.45	-.05	0	0		92			W
	17.33	4.48	-.02	6	0.394		116	↓	1724	J
	17.15	4.52	+.02	0	-		-	0		-
	17.44	4.44	-.06	0	0	↓	94.0	200		W
	17.43	4.45	-.05	6	.392	?	111.0		17	W
				0	0		102.			J

Treadmill Locomotion Meas., Con'd.

r Quinton TM # 6801, 7701

MpH	T/10 Rev Sec	Calc. MpH	Error MpH	Grade %	V/ Fps	ΔT min.	Wt. Lbs	Mode W/J	H.Rate BPM	ΔHR BPM
-----	-----------------	--------------	--------------	------------	-----------	--------------------	------------	-------------	---------------	--------------------

27 Mar 1996 TM 7701

Belt. r = 11.42

3	25.46	3.058	.058	0	0	3:00	200	W	72	-
	.50	.053	.053	0	0				72	-
	.41	.064	.064	3	.135 ₊				78	6
	.52	.051	.051	0	0				72	-
	.38	.068	.068	6	.269 ₊				88	18
	.48	.056	.056	0	0				72	-
	.35	.072	.072	9	.404 ₊				94	22
	.48	.056	.056	0	0				75-6	
	.46?			3					78-80	? 4-6
	.49?			0					74	-
	.47			3					?	-
	-			0					74	-
	-			3					80-1	6-7
	.40			0					74	-
	.41			6					88	14
	.47			0					74	-
	.47			6					88	14
	.42			0					76	-
	.26			6					88-9	12-3
	.49			0					76	-
	-			9					96	20
	.57			0					76	-
	.37			9					94	18
	-			0					77	-
	.50			0					76	-
	-			9					97, 6, 7, 7	20
	-			0					76, 7, 6, 6	-

3; 4; 5; 6:
"

+ An r of 3.06 mph was used

28 Mar.

29 Mar. '96 Overground HR vs Velocity Measurements - W.T. 701 Cows Crk.

Essentially level gravel in asphalt road - not smooth - Divided into 100' sections $\pm 2-3''$. Times for 100' unless noted

28 Mar. ~65°F No wind Heart rate by Polar. T.M.

100ft	Laps	Time	Vel. ft/sec	Time Sec.	Vel. ft/sec	Time Sec.	Vel. ft/sec	Time Sec.	Vel. ft/sec
1	1	17.34	5.76	18.42	5.43	17.40	5.75	17.48	17.96
	2	.46	.73	17.47	.72	.25		.45	.44
	3	.19	.82	18.19	.50	.66		.28	.18
	4	.42	.74	17.94	.58	.66		.67	.54
	5	.57	.69	.87	.60	.67		.42	.40
	6	.77	.63	.91	.58	.51		17.64	.88
	7	.83	.61	.80	.62	.13	5.83	18.00	.25
	8	.43	.74	17.99	.56	.60	5.68	17.99	.65
	9	17.73	.64	18.21	.49	.97	5.56	17.68	.52
2	10	35.26	5.67	17.92	.58	17.52	5.70	17.47	17.67
11				10		10		5.62	17.52

$\Sigma 10$ 3' 14.00" 5.67 $\checkmark$ 2' 59.72" 5.56 2' 55.37" 5.70 2' 56.68" 5.66 2' 55.49"

$\Sigma 9$ 2' 38.74" 5.67 2' 41.80" 2' 37.85" 2' 39.21" 2' 37.82"

Heart Rate 727173 $\rightarrow$ 273 $\rightarrow$ 272 $\bar{X}$ MPH = 3.86

3.79

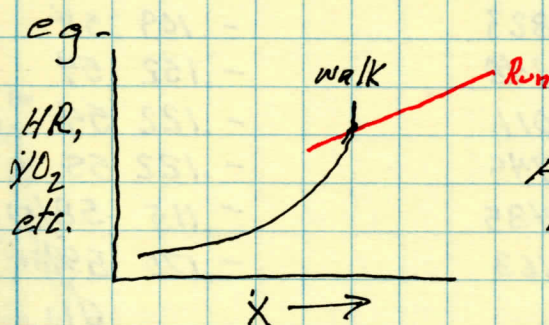
3.89

1
2
3
4
5
6
7
8
9
10

30 Mar. OG & TM locomotion - Summary

For some time I have attempted to combine personal exercise & data gathering for comparison of OG to TM locomotion as regards H.R. response.

The horizontal locomotor response is well established.



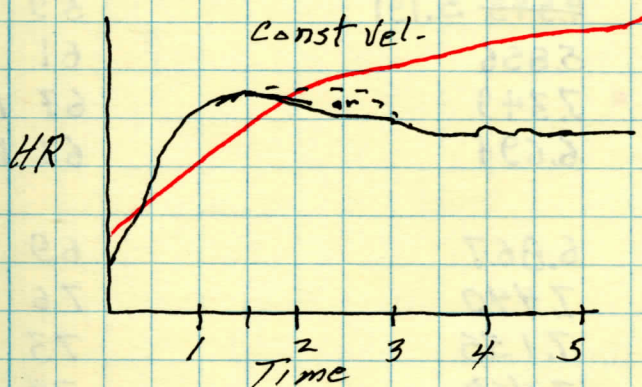
and my response was typical.

This data was plotted on P. 123 of prev. N.B. and data is on:

Prev. P. 105^{14.2.96} TM- $\Delta \dot{R}$, $\Delta \dot{Y}$, H.R. Holter tape
 N.B. P. 107 24 Feb Holter tape
 115-29.2 $\Delta \dot{R}$, $\Delta \dot{Y}$, HR on TM
 119-7.3 $\Delta \dot{R}$, $\Delta \dot{Y}$, HR on TM
 120-23.2 OG $\Delta \dot{X}$, HR

There is great variability, at times, and great consistency at times. Will try a new tactic today. In addition to time, temp. etc. will walk jog until ~~3~~ 5 x 10 sec const HR is achieved and will record 3 to 5 epochs & 3 min intervals stdg. (rest) between.

Without a recorder one can only give impressions which were:



There was an initial period of relative stability followed by a decrease & variability until a new lower level is reached. If capacity is exceeded the rate continues to increase.

Walked and jogged at increasing rates. P. 58

N.B. - It is obvious that H.R. $\uparrow$ & repeated fast runs.

① Repeat data & 2* TM

② Repeat road data & single ~~trials~~ at fixed HR & meas last 4-500'
 ? try cadence walk.

* $\dot{A}$ - /read
 velocity
 $\dot{Y}$ - vertical
 velocity

30 Mar, 96 Heart rate vs veloc., Zero grade - TM timed $\bar{c} + \bar{s}$ load

Quinton #0681 71°F Belt - 11.375 Zero elevation - Walk, 200#

Indicated MPH	ΔT -load Secs	ΔT load Secs	Vel/UL ft/sec	Vel/loaded Ft/sec	Δ Vel. ft/sec	Error ft/sec	HR ² P B PPM P	ΔT Min:Sec
1.0	39.12	41.23	1.454	1.379	-.082	58	57-8	3:15
2.0	19.39	20.14	2.933	2.823	-.109	54	62	4:53
3.0	25.83	26.78	4.404	4.248	-.152	54	64 1/2	6:53
3.5	22.0	22.7	5.170	5.011	-.122	54	69 1/2	4:44 6:40
4.0	19.29	19.8	5.897	5.745	-.122	55	75	6:32
4.5	17.16	17.54	6.629	6.485	-.115	58/59	84	3:31
5.0	15.23 47	15.47 88	7.353	7.163	-.170	59/54	97/6	4:31 6:5
		Log				61	90	4:13 40
4.5	17.22	17.55	6.606	6.481	-.119	↓	↓	↓
5.0	15.47	15.81	7.353	7.195	-.139	63	98	5:3
6.	12.89	13.25	8.825	8.585	-.215	65	106	5:3
6.5	11.78	12.28	9.654	9.263	-.270	66	112	5:1
7.0	11.015	11.33	10.326	10.040	-.227	66	118 1/2	6:1
7.5	10.33	10.70	11.012	10.631	-.369	67	124	7:1
8.0	9.64	10.03	11.800	11.341	-.392	70	135	6:4

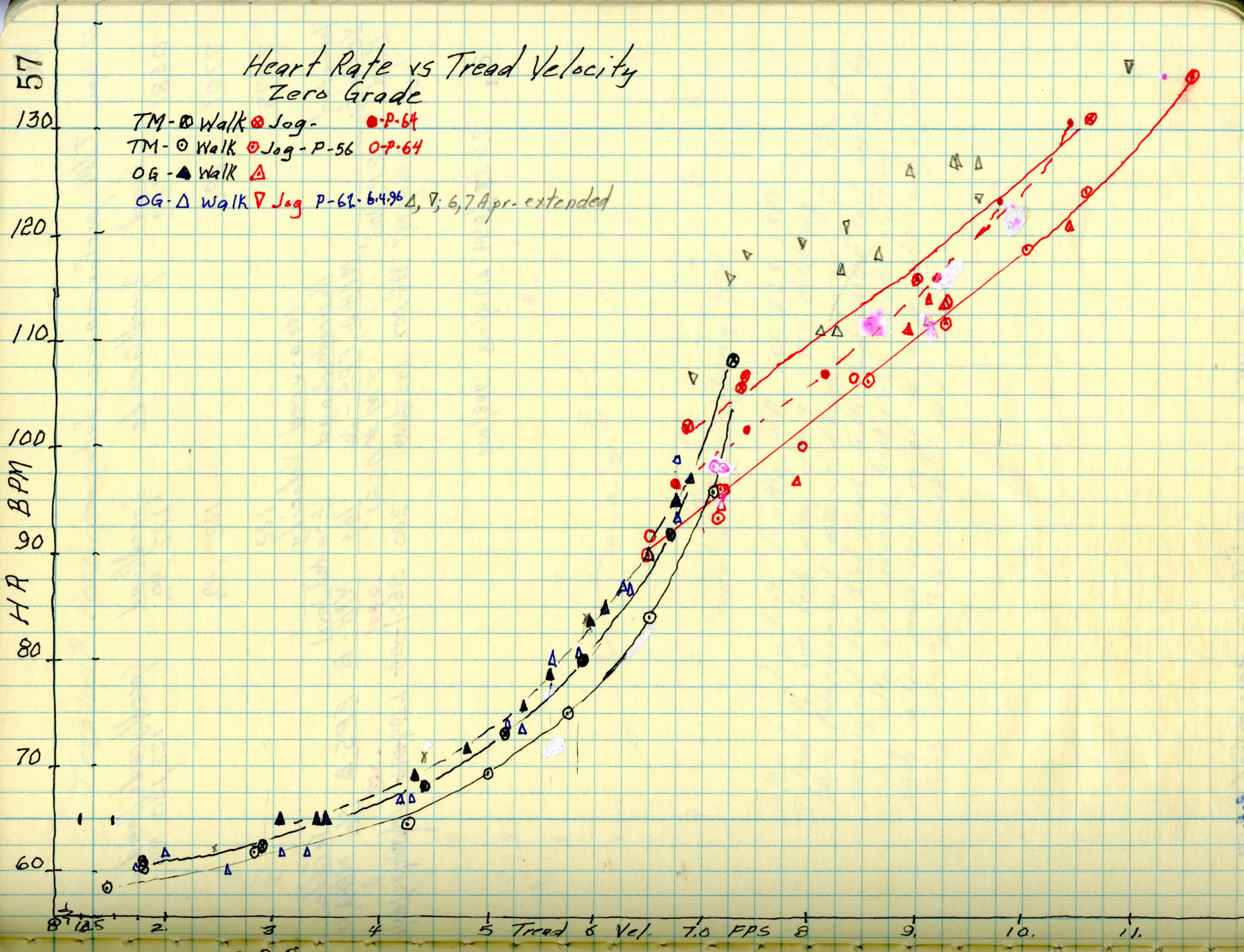
1 April T.M. 7701 Belt 71°F 11.42

1.2	6.39	6.39 (1 Rev)	1.787			58	61	5:00
1.2		6.39 ↓	1.787			58	60	5:00
2.0		38.84 10 Rev	2.940			56	62 (1.5)	5:00
3.0		25.69	4.445			57	68	4:00
3.5		22.00	4.545 5.191			59	73	
4.0		19.50	5.856			61	80	
5.0		15.54	7.349			67	108	5:00
4.5		17.06	6.694			66	102	

		Log						
4.5		16.63	6.867			69	102	5:30
5.0		15.35	7.440			76	107	5
5.0 6.0 *		15.36	7.155			73	103	
5.0		15.29	7.468			74	106	
6.0		12.69	8.999				176	
7.0		10.73	10.643				131 1/2	5:30
4.4	5.50						97	~5:30

Heart Rate vs Tread Velocity Zero Grade

TM-⊗ Walk ⊗ Jog- ● P-64
 TM-⊙ Walk ⊙ Jog-P-56 ○ P-64
 OG-▲ Walk ▲
 OG-Δ Walk ▽ Jog P-61-64% Δ, ▽; 6, 7 Apr. extended



12 Apr. T/M performance; data on

0681 $\frac{\text{Speed}}{122}$ $\frac{\text{Speed/Grade}}{122}$ $\frac{\text{Speed/load}}{122, 49,}$ $\frac{\text{Speed/grade/load}}{122, 130, 49,}$

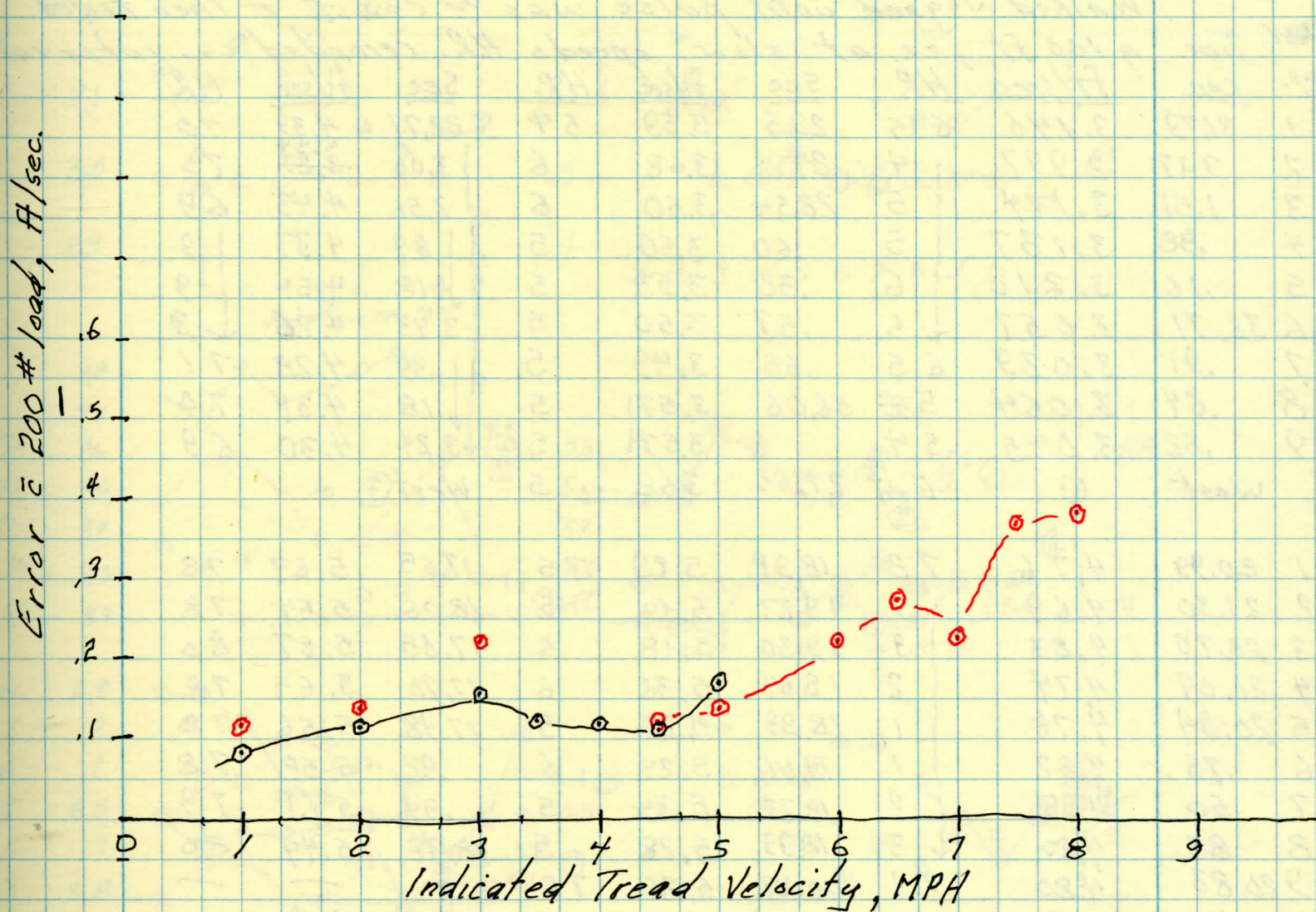
7701 122 122, 49,

7699 122

Indicated Velocity, MPH	Measured Velocity							
	No Grade or Load		Loaded, level				Grade	
	MPH- Δ	FPS- Δ	lbs	MPH- Δ	FPS- Δ	%	MPH- Δ	FPS
1.2	1.466	1.447	993	1.457	1.409	200	1.394	1.376

2.2 2.933/.894 2.930/.003 1.998/.002

Treadmill Performance



Called Quinton Inst. Seattle, WA 206 223 7373
 Talked to suc. tech. who → x 2448 Hotchberg
 Stan Peterman - ? ~~etc~~ called back - Apparently Quinton has
 redesigned the Club Track TM for 'softer' foot impact' by
 using softer belt, reducing track platen & frame stiffness. They
 have a low mass rapid response motor which adj & servo
 which adjs. "pwr." to speed desired.

31 Mar. O.G. locomotor times Low Crk. 1600-1723 70-77°F - W-0-10 E

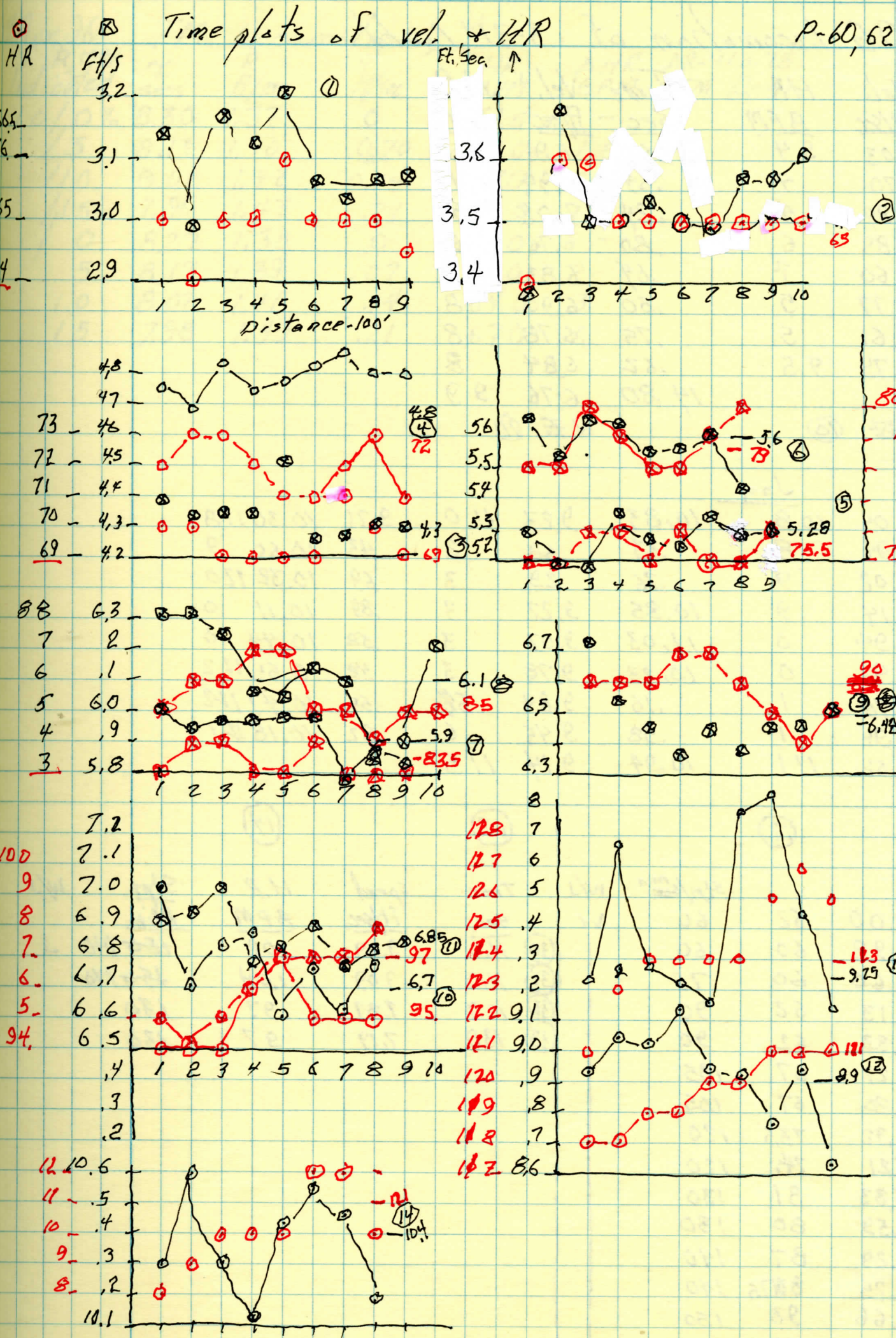
Walked logged until pulse was ~ const. & then timed
 9 100 Ft., ex. at slow speeds H.R. recorded ca. interval

Lap	Time	Sec	Ft/sec	HR	Sec	Ft/sec	HR	Sec	Ft/sec	HR
1	31.79		3.146	65	29.5	3.39	64	22.77	4.39	70
2	3.37		2.997	4	27.15	3.68	6	3.06	3.27	70
3	1.51		3.174	5	28.54	3.50	6	2.56	4.43	69
4	.88		3.137	5	.60	3.50	5	.89	4.37	9
5	.16		3.210	6	.32	3.53	5	.18	4.51	9
6	32.71		3.057	5	.57	3.50	5	3.43	4.28	9
7	.91		3.039	65	.65	3.49	5	1.39	4.28	71
8	.84		3.064	54	56.06	3.57	5	.18	4.31	70
9	.62		3.075	54		3.57	5	3.24	4.30	69
West ①			East 27.63			3.62	5	West ③		

1	20.99	4.76	72	18.91	5.29	75	17.65	5.67	78
2	21.30	4.69	3	19.27	5.19	5	18.06	5.54	78
3	20.70	4.83	3	19.30	5.18	6	17.65	5.67	80
4	21.09	4.74	2	18.64	5.36	6	17.20	5.65	79
5	20.94	4.78	1	18.99	5.27	5	17.98	5.56	78
6	.73	4.82	1	19.04	5.25	6	.92	5.58	78
7	.50	4.88	2	18.73	5.34	5	.84	5.61	79
8	.83	4.80	3	18.93	5.28	5	18.37	5.44	80
9	20.83	4.80	71	18.87	5.30	76	—	—	—
East ④			West ⑤			East ⑥			

1	6.06	16.5	8	3	<u>31.7</u>	6.31	8	5	14.84	6.74	9	1
2	5.95	.8		4	<u>15.85</u>	6.31	8	6	15.30	6.54	9	1
3	5.97	.76		4	16.00	6.25		6	15.45	6.47	9	1
4	5.84	17.12		3	.47	6.07		7	.69	6.37	9	2
5	5.93	16.85		3	.57	6.04		7	.51	6.45	9	2
6	5.95	.82		4	.31	6.13		5	.65	6.39	9	1
7	5.76	17.35		3	.69	6.10		5	.47	.46	9	0
8	5.89	16.99		3	17.12	5.84		4	.43	.48	8	9
9	5.83	17.15		3	16.96	5.90		5	15.33	.52	9	1
West ⑦					16.66	6.22		5				
					East ⑧			West ⑨				

All Walking.



1 April OG Locomotion of 3.31 contd

Time	Vel.	HR	Time	Vel.	HR
Sec	Ft/sec	BPM	Sec	Ft/sec	BPM
14.22	7.03	94	14.42	6.91	95
.92	6.70	4	.64	6.94	4
.61	6.84	4	.24	7.02	5
.51	6.89	6	.20	6.76	6
15.15	6.60	7	.64	6.83	7
14.78	6.77	5	.50	6.90	8
15.13	6.61	5	.75	6.78	8
14.73	6.79	95	.62	6.84	8
			14.80	6.76	99

E ~~10~~ ⑩W ~~11~~ ⑪

			Seg						
11.05	9.05	108		10.83	9.23	110	9.71	10.30	118
11.19	8.94	8		.33	.68	2	.43	10.60	9
11.09	9.02	9		.76	.29	3	.69	10.32	120
10.94	9.14	9		10.85	9.22	3	.89	10.11	0
11.18	8.94	0		11.03	9.07	3	.52	10.44	0
.22	8.91	0		10.23	9.78	3	.42	10.55	122
.41	8.76	1		.16	9.84	54	.55	10.47	122
.19	8.94	1		.52	9.45	6	.82	10.18	121
11.62	8.62	111		10.94	9.14	115			

6 Apr

⑫

⑬

⑭

			steps/min	W/L	Time	speed	H.R.	Steps	W/L
					Sec.	Ft/sec.	BPM	Min	
15	50	2.00	62	60					
16	50.5	1.98	60	60	⑩	9.09	102	150	140 J
17	38.5	2.60	60	75	⑪	9.09	104	150	140
18	31.9	3.13	62	90	⑫	7.87	97	130	
19	30.0	3.33	62	90	⑬	7.19	97	130	
20	23.4	4.27	67	105					
21	23.8	4.20	67	105					
22	18.8	5.32	73.5	120					
23	19.2	5.21	74.	120					
24	17.15	5.83	81	130					
25	17.9	5.59	80	130					
26	15.9	6.29	87	140					
27	16.0	6.25	87.75	140					
28	15.0	6.66	93	150					
29	14.9	6.71	93	150					

4 Apr. 96 T.M. Locomotion, $\dot{Y}$

R, MPH Indicated	γ secs	R ft/sec	$\dot{Y}$ ft/sec.	HR BPM	Δ HR BPM.	AR- 113.75' T.M. 6/08/
1.0/0%	8.30	1.37	0	61.5	-	
/5	8.13	1.40	.070	63.0	1.5	
/10	8.02	1.42	.14	67.0	5.5	
/15	7.96	1.43	.21	69.0	7.5	
/0	8.27	1.38	0	59.0	-	
5	8.17	1.39	.07	61.0	2.	
10	8.07	1.41	.14	64.0	3.	
15	7.98	1.43	.21	67.0	6.	

12 April TM locomotion - Data W.T. - 195[#] met. wt. $\approx$ 200[#] on T.M., ϕ grade 6

Indic. k, mph	$\bar{r} +$ sec.	$\bar{r}$ fps	T / HR	**
4.5	17.59	6.486	4:30/92	Δ 15 - 92, 2, 3, 1 - 92
5.0	15.85	7.2118	2:45/95	" 95, 5, 6666 - 96
5.5	14.45	7.9787	5:10 /	$\overline{100}$
6.0	13.56	8.39	5:15 /	$\overline{107}$
6.5	—	—	3:/113 4:/114 5:/115 6:/117 7:/117	
6.5 (on OTM)	—	—	8:/127 9:/130 10:/127	

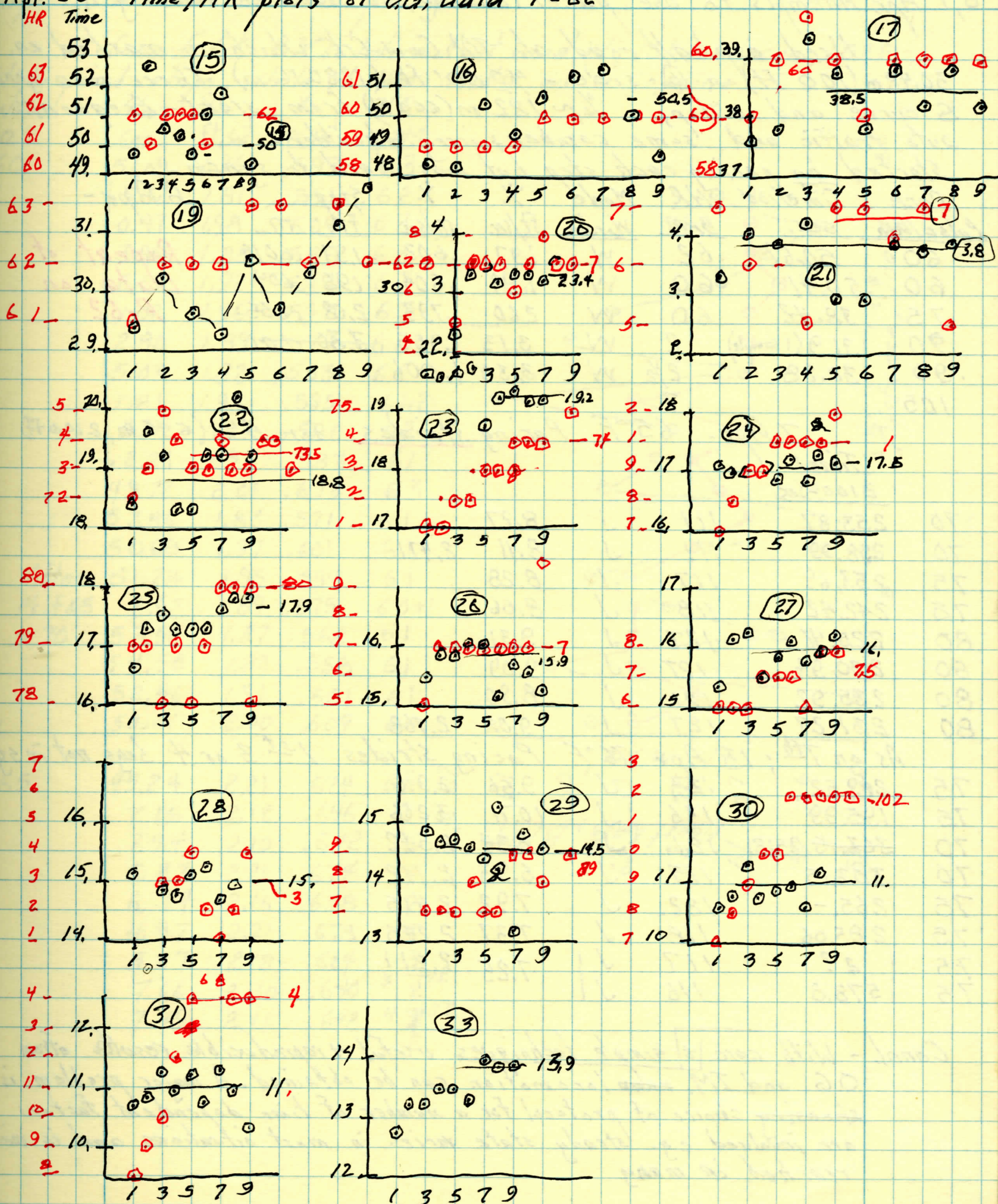
12 A TM 0771 1500[#] Temp. 67.5 R/5 + 69°F Thermostat

4.5	16.99	6.72	3:/97	5:/96
5.0	15.44	7.40		6:45/102
5.5 Δ	14. -	8.16	3:/106	4:/107 5:/108 6:/109 7:/109
6.0	12.87	8.87	3:/105	4:/106 5:/107 6:/108 7:30/107
6.6	11.76	9.71	3:/123	4:/122 5:/123 6:15/124
7.0	11.00	10.38	3:/128	4:/129 5:/131

** TM 0681 belt = 11.375

* TM 0771 - belt = 11.72, Jog; + 10 rev. Δ - δ done at $\bar{p}$ 7.0 mph.

de 6 Apr. 96 Time/HR plots of OG, data P-62



66

13 Apr. Transcription of O.G. data.

6, 7 Apr. Attempts to use pacer (audible) to stabilize velocity R/S #63-5013

Used asphalt road at 701 Cow Crk. which is marked eq. 30.48m (100 ft) on @ side - 4200' ft. (1280.16 m). There is a gentle S curve and a dip, $\frac{1}{2}$ ~ 182 m (600 ft) from start - Frequent auto traffic and some camber + irreg. shoulder -

Started by pacing each step but was hard to synch -

Pace	Time/100'	HR	Mode	X	X	Step		6 Apr -
Pulse/min	sec.	BPM	Work Log	Ft./sec	m/sec	Ft.	m	
60	50.67	62	W	1.97	.602	1.97	.6015	Repeat of Data on P-62
60	50.41	60	W	1.98	.604	1.98	.604	
75	38.42	60	W	2.60	.793	2.08	.635	
90	31.9 (1 sample)	2	W	3.13	.955	3.30	1.01	
90	30.28	2 1/2	W	3.30	1.006			
105		7						

7 Apr. 65°F Pacing strides for .4 mi (640 m, 2100 ft)

	Time/ 2100 ft/sec				
70	253.87	111	J	8.27	
70	258.99	111	J	8.11	2.471
75	253.69	117	J	8.28	
75	242.42	118	J	8.66	
80	225.46	127	J	9.31	
80	230.94	127	J	9.09	
80	235.92	126	J	8.90	
80	231.27	127	J	9.08	2.768

As on 7th; 13 Apr 76°F Pacing strides 1st 3 or 4 legs, not in sync.

75	249.52	123	J	9.56	2.916
75	195.99	136	J	10.71	3.266
70	303.15 251.81	121	J	8.34	2.542
70	303.15	117	J	6.93	2.112
75	265.-	122	J	7.92	2.415
75	285.06	118	J	7.37	2.245
75	2?	117	J	7.25	2.211
75	578.8	116	J		

Concl. - With care & simple techniques useful & reproducible results from O.G. and IM, ~~from~~ locomotion can be obtained. A major problem is choosing choice of protocol for a number of time dependent factors are involved e.g. steady state varies in most situations and is never reached in many

14 Apr. OG locomotion & pacing -

Conwards Crk. 83°F Intermittent wind, W ~ 10K and sun; 1525

Initially paced steps while W then strides while jogging -

Pace/min T_{100} X X HR

60 Sec. ft. sec⁻¹ m. sec⁻¹ BPM

51.09 1.96 .597 63

5.32 1.81 .551 62

0.47 1.98 .604 63

3.96 1.85 .565 63

2.15 1.92 .584 63

1.02 1.96 .597 63

2.80 1.89 .577 62

5.03 1.82 .553 61

1.21 1.95 .595 61+2

1.94 1.93 .586 62

2.21 1.92 .583 61

49.72 2.01 .613 63

53.46 1.87 .571 61

50.68 1.97 .601 61

After 51.24 1.95 .594 61

P's of 65 2.92 1.89 .575 60+1

* 70 53.58 1.87 .568 61

54.58 1.83 .558 61

52.46 1.91 .581 61

50.01 2.00 .609 60

65 45.24 2.21 .674 63

7.15 2.12 .646 3

7.44 2.10 .642 3

5.23 2.21 .674 3

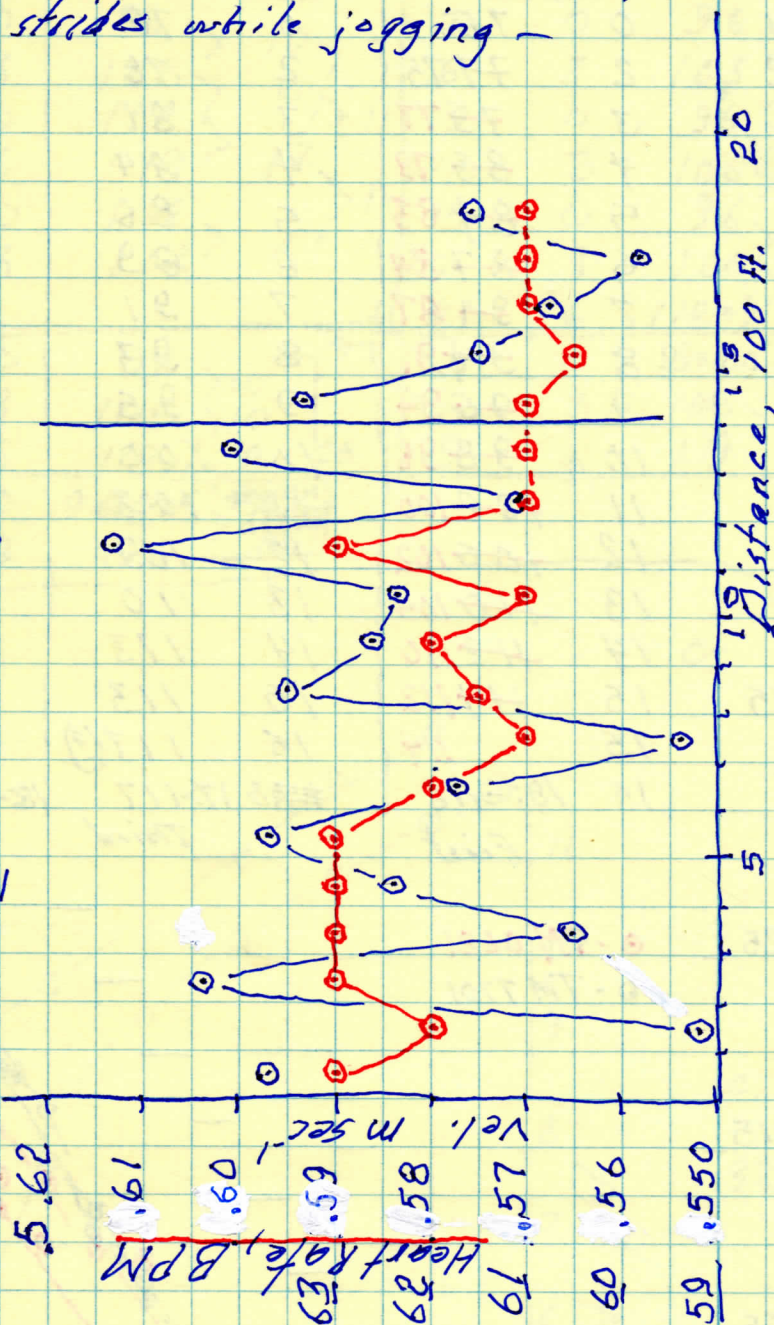
6.34 2.16 .658 2

4.97 2.22 .678 3

5.87 2.18 .664 3

7.66 2.10 .640 3

7.49 2.11 .642 4



5.62
1.61
.60
.59
.58
.57
.56
.550

Heart Rate, BPM
63
62
61
60
59
58
57
56
55

15 Apr. Balke T.M. W.T.

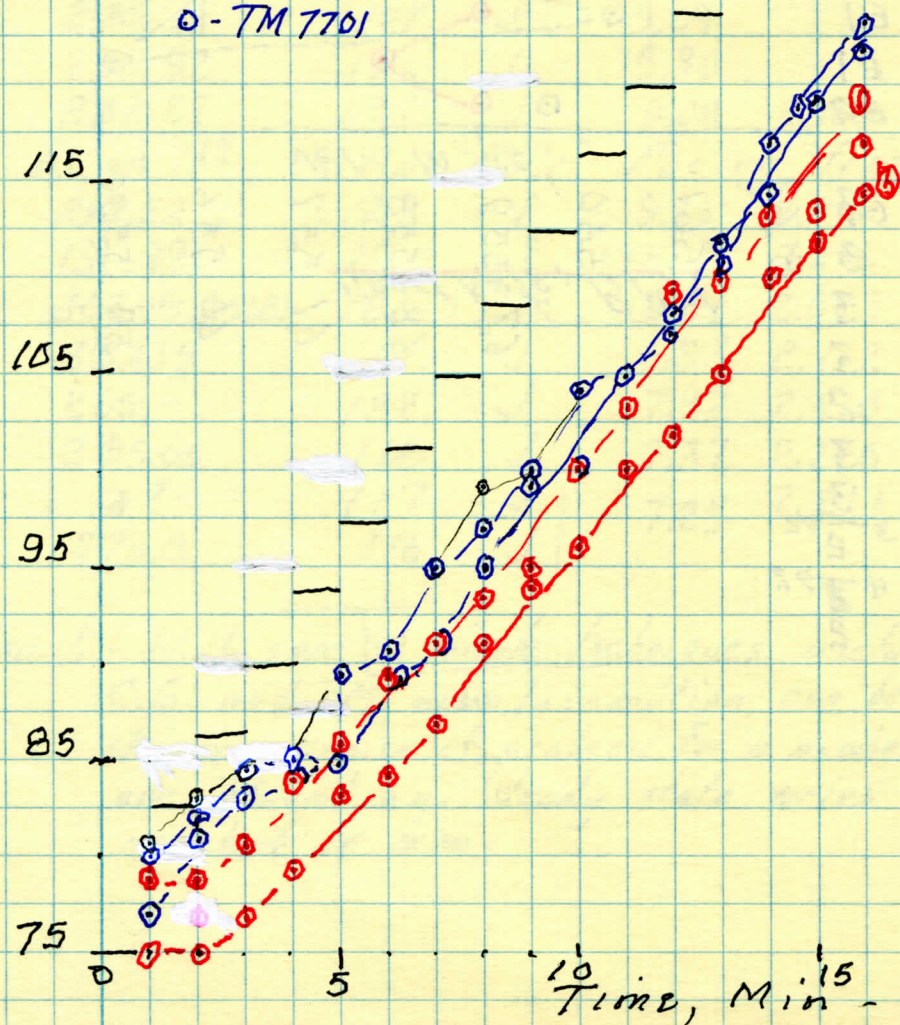
3.3 mph Walking

Results

Time, min	Grade, %	HR BPM	Grade %	HR BPM	HR BPM	HR BPM	HR BPM
0-1	0	75	6	78	77	80	
1-2	2	77 75	2	78	81		
2	3	79 77	3	81	83		
3	4	83 79	4	84	84		
4	5	84 83	5	86	85		
5	6	87 84	6	89	89	91	
6	7	91 87	7	91	91	5	
7	8	94 91	8	93	95	7	
8	9	96 94	9	95	99	100	
9	10	98 96	10	100	100	24	
10	11	102 100	11	103	105	104	
11	12	105 102	12	109	108	107	
12	13	110 105	13	110	112	111	
13	14	112 110	14	113	114	117	
14-15	15	114 112	15	113	119	119	
15	15	114	15	117(?)	122	123	
	15	18:-116	15	17:-117	18:-124		
		First		Third	Second		

Results have been inconsistent as regards ΔHR as $F(Y)$ - with 4 try a jogging Balke protocol - 4.5, 5.0, 5.5, etc. mph.

○ - TM 0681
○ - TM 7701



Fourth

15

14

13

12

11

10

9

8

7

6

5

4

3

2

1

0

Time, Min

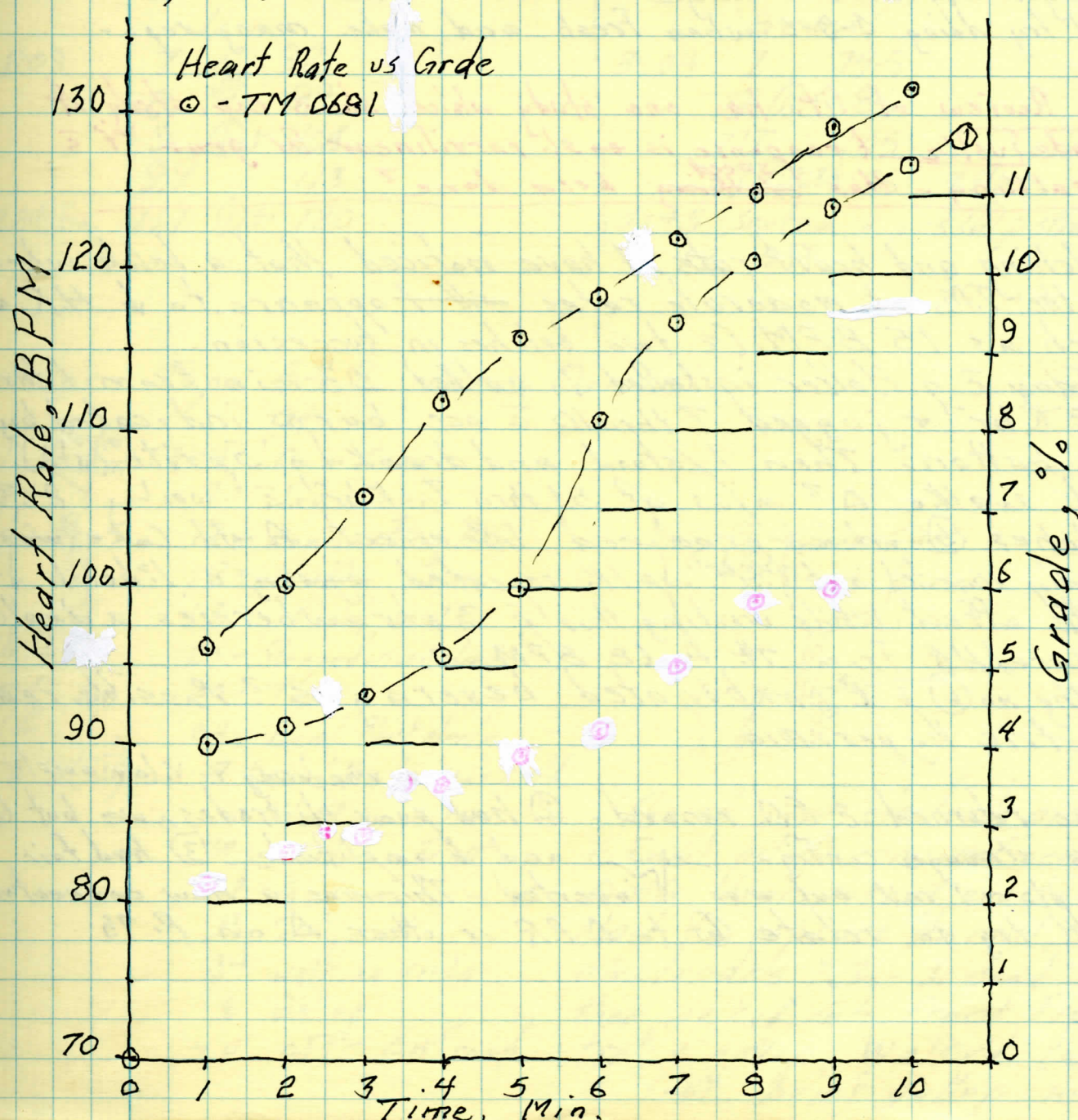
16 Apr. Modified Balke For HR-Y

4.5 mph - Jogging
TM #0681 W.T.

Time, min	Grade %	①HR BPM	②HR BPM
0	0	60	70
1	0	90	96
2	2	91	100
3	3	93	106
4	4	96	112
5	5	100	6
6	6	111	8
7	7	117	122
8	8	121	5
9	9	124	9
10	10	127	132
11	11	TM 17.	1
12	12	44.37, 42	39, 40

Time, min	Grade %	HR BPM	Δ HR BPM
0	0	98	
3	3	108	10
6	0	102	6
9	6	119	17
12	0	102	
15	3	108	6
3	0	98	
6	3	108	10
9	6	118	10
3	0	98	
6	9	126	28

El. Time min	Grade %	HR
3.	0	96
6.	3	103
9	0	96
12	3	106
15	0	96
18	3	106
21	6	118
3	0	99
6	3	108
9	6	119



0	98
	102
	102
	98
	96
	96
	96
	100
	96
0%	98.2
3%	103.
	6.
	6.
	8.
	8.
	8
Δ	706.2
Δ_5	8.0
6%	118.5
	119.0
	119.0
	117.5
	474.0
	118.5
Δ_5	12.3
Δ_6	20.3

17 Apr. Comments.

The data on prev. pages show the difficulty of doing comparisons at various levels. As effort increases there is a build up of: O_2 deficit (O_2 debt)

Temp.

Alteration in energy substrates, etc.

This is clearly seen on P-69 when the constant vel. ($\dot{v}=k$) - Δ grade (1%/min.) protocol is repeated over a short period. A series of meas. at several ~~re~~ increasing velocities $\bar{c}$ 4 grades at eq. velocity showed a curvilinear response for $\dot{V}$ when I but not running. This seemed to be the case in the lit. but have had trouble reproducing it; eg P-69.

Today I tried repeated increases/decreases at 1 velocity and got expected change from 0 $\rightarrow$ 3% $\rightarrow$ 6% but not 9%. Will try doing 0-9-0 when fresh and make many reps.

NB. Review of lit. has one study which shows ex. study of grade vs O_2 response is easl. curvilinear for grade $\dot{V}$ $\bar{c}$ walking - Has ~~walking~~ ^{speed} been done?

19 Apr.

Belching and heart rate. I have noticed that a belch when on the T.M. at moderate rates ~~will~~ appears to $\downarrow$ H.R. as much as 15 BPM. ($\bar{c}$ two belches in succession.

Today $\bar{c}$ a Holter installed I walked Δ 3 min from 1 thru 9 $\dot{V}$ $\bar{c}$ $\dot{V}$ $\bar{c}$ jogged 7 thru 10 $\bar{c}$ occ. burps indicated by pt. button. Then I stood and drank a 'Sprite' (std.) and walked Δ 3 mins at 5.1 thru 7. $\dot{V}$ $\bar{c}$ only 2-3 belches $\bar{c}$ which produced little effect. A std. Coke was rapidly ingested and T.M. walk repeated ~~again~~ $\bar{c}$ 1? belch of little effect. While writing this $\bar{c}$ 2 strawberries a dual $\bar{c}$ reduced H.R. from 74 to 68 BPM.

Why no $\bar{c}$ $\bar{c}$ carbonated beverages? Possible reaction gastric hyperemia.

24 Apr.

Tape returned $\bar{c}$ E.D. record. $\bar{c}$ had poor electrodes, we but $\bar{c}$ was strange config. $\bar{c}$ and $\bar{c}$ amplitude. $\bar{c}$ had fair ampl. $\sim$ 1 mV but was $\bar{c}$ inverted - This was a new connector. Will try to relate $\bar{c}$ to Δ RR or other Δ on P. 75

19 Apr. 96 T.M., ⑥ study Holter Monitoring: Tape B1.1

Time 13:12 Start. electrode config. on P-70 Used batt., Sony Tape
25 Auto Cont'd.

TM 0681 0% Grade,
+ = pt. batt. Indic. Heart 1581 Walk
activated Speed Rate
K hr⁻¹ B min⁻¹

1:40 1.6 58
3 3. 59
6 4. 63 + squeeze
↑ rate
1:50 5.1 66 + ⑥

4 6.1 71
6 7.0 79
9 8.0 90 + ⑥
2:05 Fini. 9.0 118 ⑥

Jog
2:09 7. ⑥ 92
8. ⑥ 99
9 ⑥ + 108
9.9 113

2:24 Fini. 11.1 ⑥ + 120

Time Vel. H.R.
2:28 — — started 'Sprite' } no ⑥ but
32 — — Fin " } sensation
↑ HR

Walk
2:33 5.1 75
7 6.1 78
7. 86

2:47 Drank - std. Coke

2:49 - No ⑥

2:49 - 5.1 72

6.1 77

7.0 ⑥ + 86 no Δ HR seen ⑥

'Bruce'

3:04 I 74.5

II ⑥ + 86

III 105

IV (2:30) 136 43/15%

3:45 Seated 2 prs ⑥ p strawberr. Δ 5 BPM

4:42 OFF

20 Apr. Tape B-1.2 Jen & Domini
St

Under Bra 1304 Dom Conn
7 Jen Conn
17 - Connecting Fir.
17 - Walk Slow
18 - Field, walk
20 - Stopped-switched
20 - Trot
24 - Repl Neck electr.
7 - Walk to rear field

Walking in rear "

30 - Switch - Trot

32 Gallop

33 Trot, walk

34 Walk in woods

6 Gallop

40 OFF - On road



Shaved above electrode areas & degreased
w/ Enail polish remover (acetone) & used
DMA transparent electrodes -
Had to replace dorsal, ① shoulder,
electrodes X Z - J. stood @ D and
then walked into front field, tried to
trot & gallop - Walked to rear field
& trot, brief gallop walk in woods

Tape B-1.2 contd.

20 Apr.

W.T. leading Domini

✓ & back in field for gallop & stumble (hole) & into front yard where I connected, D, and walked & D. trotting with 100' timing, then jog & D trot & walk & D walking until she. Halter startled & D.C. electrodes - 100' T are below.

Time

13:48

W.T. - W D-Trot

15:35, 14:25 --- } Per

13:57, 13:58 } 100'

12:73, .91

Stopped -

W.T. - J D-Trot

10:48, 9:61, .14,

:56 .02, 8:63, 9:13(?)

Stopped

W.T. - W D-W

20:37, 19:47, 18:92

.43, .40, .95, 86, .56

Stopped - D spooked

pulled electrodes

148 walk & W T
W T W - D.T., 15:35 14:25
52.15 13:53:88.58
12:73 .91
J - D.T. 10:48 9:61.14
9:07 8:63.13
:56 15

B1.3

Will now put on 2 & EKG & walk at above then do

3, 2 mi - B1.3 - 100' 'laps'

5-3:28 ? Walk

Jog H.R.

n	T _n	HR
1	28.74 sec	? BPM

2 23.22

3 21.16

4 19.90

5 19.90

6 19.68 74

7 .98 75

8 .83 75

n	T _n	HR
1	9.27	

2 .13

3 .24

4 .60

5 .91

6 .73

7 .82 118

8 .90

Walk

1 83

2 15.68 87

3 15.60 88

4 15.60 91

5 15.28 90

6 15.92 89

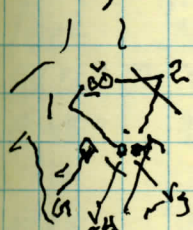
7 15.90 89

8 16.02 87

Jog; P-75 not in synch. 7x.4mi
6 W. 4 mi - 3 4:09 H.T.
1 - 3'49.57" - ~118 5 - 4'08.9 - ~130
2 - 44.65 - ~125 6 - 4'13.94 - ~128
3 - 4'04.41 127 7 - 4'25.57 - 117-129
4 - 4'02.87 127 8 - 7'38.27 ?

Tape B.1 cont'd.

22, 3 Apr. 'Diagnostic' run B-1.4



After several atypical brief pain episodes in acromioclavicular joint and c. 15 sec. pulse of 144 installed the Roter-Pt. marker actuated to subs. pain and also burps. Went to movie, restaurant, home, bed v. deep sleep, up 4X urination, 1st, letter, and then jogged 8 X .4 mi. laps marked ea. 100'. 72°F

Zoo Sacrum

H.I.

7:44

7:50.5

+

No stop

8:58

1

2

3

4

Stop to record

1

2

Non stop

1

2

3

4

Stop; defecate

HT 9:16

1

2

3

4

Non stop

1

2

3

4

Stop; Record

1

2

3

4

HR-133

3'30.56

Yn

secs

3'59.19"

10.95

10.84

4'20.98

3'20.21"

10.27

11.02

9.95

3'51.45

3'17.62"

9.48

3'27.10"

3'00."

9.66

9.70

10.22

3'29.58"

2'41.60"

9.41"

38.60

9.48

3'39.09"

2'52.87"

9.61

9.93

9.48

3'21.89"

3'12.50"

8.94"

9.12

9.49

3'30.56

HR-133

3'30.56

2100'

1°.4 mi.

T₁

2 3

100'

2°.4 mi.

T₁

2 3 4

3°.4 mi.

T₁

2

4°.4 mi.

T₁

2 3 4

5°.4 mi.

T₁

2 3 4

-400'

6°

T₁

2 3 4

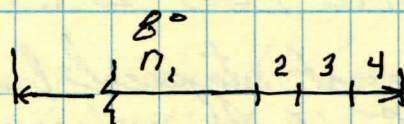
7°

T₁

2 3 4

22.4.96 Tape B-1. contd.

n	γ_n	H.R.
1	2'52.46"	136
2	9.02	
3	9.15	
4	8.98	
	3'19.61"	



7°+8° = 6'59.56 (-100')

Σ 9'45.96" Start of B1. 4 which preceded above

H.T. ? Holter time (HT) start 3:10 HT = 4:11.5

3:14 In car ? ④ 4,5 fingers tingling, HR 50
pain ④ shoulder + ~4X3:50 Park Car + in theatre
+ - 3.4X ④ shoulder

5:13 } 4X ④ - + HR 47 → 45

6:50 } in restaurant HR 47-51 driving

7:20 out of car, jogged 100 yds.

~ 6:15 Get Up

:30 BRfst. 1521

toilet ④ +

:41 writing 3④ + 46-51

:44 Up to jog -
See prev Pg.

9:48 lg cal

9:50 OFF

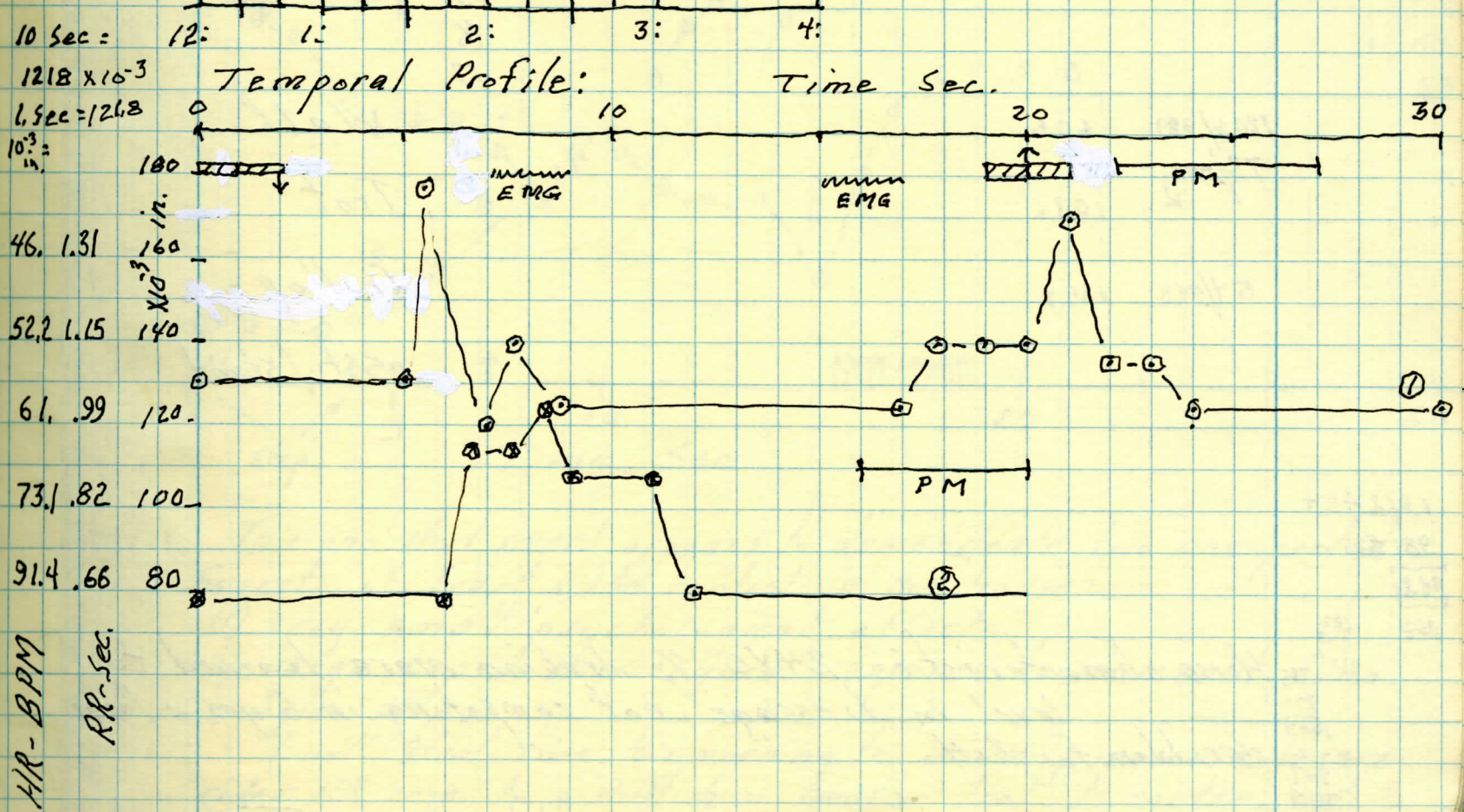
Received play back. Some conduction funny present during above c
pulsus alternans in EKG. Deltaage much reduced.29 Apr. Reviewed above c J. Wallace who had little to suggest. Obviously need
a play out of the alternans portion. Classical pulsus alternans is

⑥ analysis Tape B1.1

Time	Pl. Mk.	10 ⁻³ "/sec. Pre	'during'	Past	other events, indication
12:26.1 ①	Y				1 or 2 ↑ R-R assoc. ? E movement, EMG
13.49.1	Y				nothing
50.1	Y				nothing
14:00	Y				nothing
14.05 ②	Y				↑ RR for several beats
14.16	Y				nothing, on TM
23	Y				nothing, on TM
28	Y				no
29	Y				no
32	Y				no
33	Y				no
34	Y				1-2 Δ RR
14.45	Y				no
47	Y				no
49	Y				no
57-8	Y				no
15.00-01	Y				no
11	Y				no
44	Y				2 Δ RR
16.10					ARR 54/19 = 21% 25%

drank
sprite

drank
'coke'



25 Apr.	Review of Tape		B-1.2, 3 P.		JT/Dom, W.T./Dom.
Halter	Dom		J.T.		Condition
Time	RR	H.R.	RR	HR	
16 51.1		33 30	—	78.5	Stdg. 5 rider
55.1		31		82	Rider sitting
1703	245/2.01	29.9	85/897	86	Before Girth Adj
	1.09/1.50	55.2/37	83.7/686	87.5	p Girth Adj. p Walk.
	130/1.07	56.3	85	86	Walk - 4th HB
Transient	194/1.59 1.59	37.7			Next to g
Response	202/1.66 3.27	38.2			Last beat prior to motion
to walk	162 1.33 4.6	45.1			1
	165 1.35 5.95	44.3			2
	143 1.17 7.12	51.1			3
	138 1.13 8.25	53.0			4
	130 1.07 9.32	56.3			5
	122 1.00 10.32	60.0			6
	108 .886 11.21	67.7			7
	98 .803 12.00	74.63			8
	96 .788 12.8	76.2			9
	90 .738 13.4	81.3			10
	98 .804 14.4	74.6			11
	87 .714 15.1	84.1			12
	87 .714 15.85	84.1			13
					14
					15
					16
					17
	120.6/989	60.6			Walk
	73/579	103.6			Trot
	54/44.3	135.4			Gallop
					Sit./stand

$$1962 \div 2 =$$

981 Hrs -

988

262

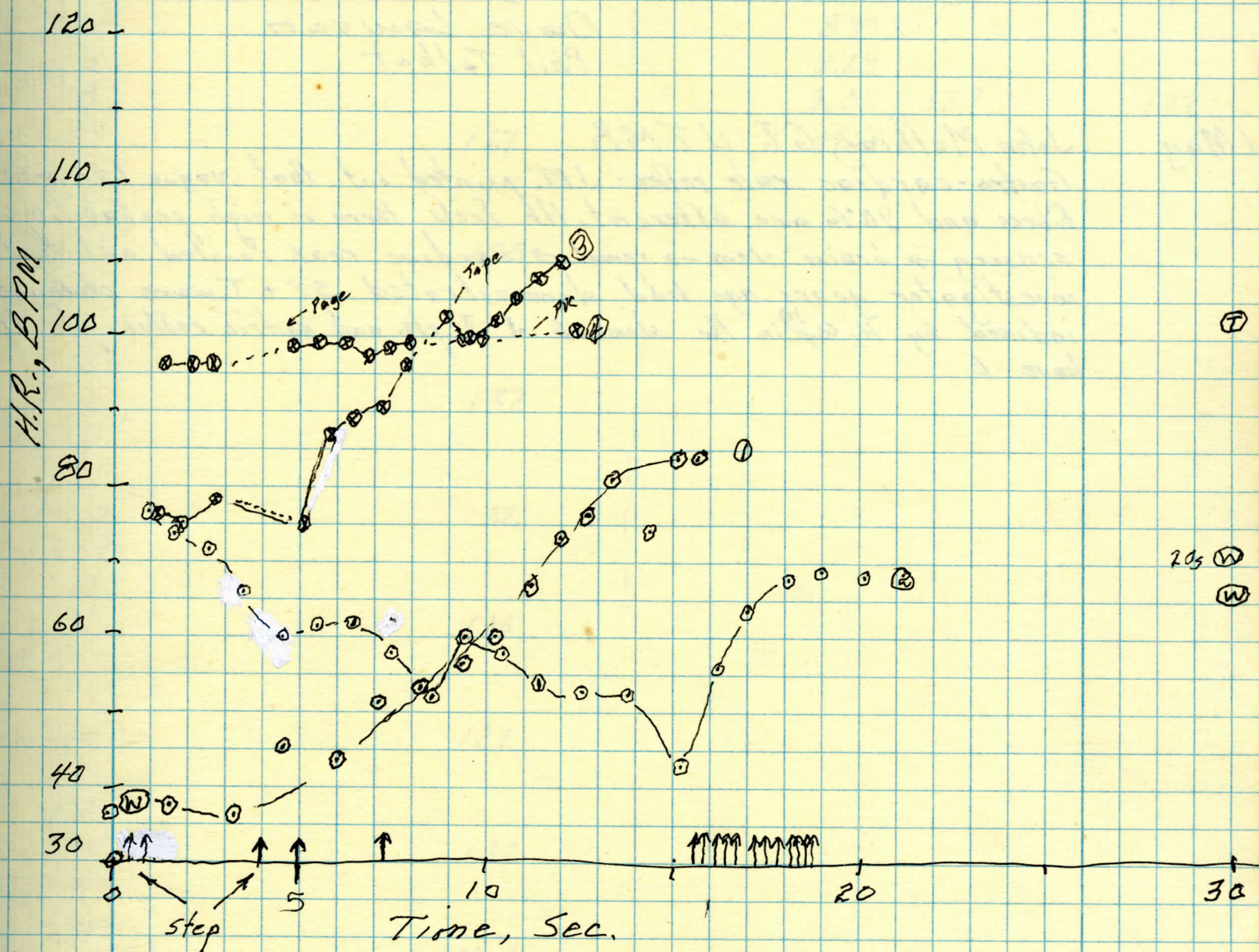
622
468
154
234
1009
790
267
1037

Horse characteristics: 24Y.O. 1/2 Arabian mare, trained to level in dressage, not competing in 6 yrs & largely unriden for 3-4

10 sec = 1219 1 sec = 121.9 JT's seated resting HR 78.5 (Polar)

[illegible]

- ① stop to initial walk, horse
- ② walk to stop (R.S.) to walk, horse
- ③ trot to center, horse
- ④ " " " , rider



Don.
Stubb's.

25449

This one short record appears to demonstrate two unexpected aspects of heart rate control in the horse:

- 1) very small 'psychological' effects
- 2) large rapid neurological response to movement, even single steps.

I will steal time this morning to manually measure horse + rider HR resp. to a shift from ~~canter~~ trot to canter, put this on field and

$$\begin{array}{r} 354 \\ \times 19 \\ \hline 695 \\ 291 \\ \hline 576 \end{array}$$

27 Apr. Summary -

- ? Article on technique - To Vet. J. or ACSM?
- " " " - To Psych Journal
- Horse + Rider, two active subjects, (pilot instructor), active, inactive - car + rider, two passive AC. passengers.
- Human Equine HR response to activity - Nature -

30 Apr - Harvey —

Tom Nawrocki —

305 243 6491*

Dave Lawson

Phil Talbot

1 May

John Mathias, G.I., UTM B

Gastro-cardiac rate reflex: J.M. pointed out that vagus has $\sim 5 \times 10^3$ fibres and 90% are afferent. He feels there is high probability of sensory $\rightarrow$ brain stem $\rightarrow$ spinal $\rightarrow$ cardiac reax. Pointed out that an investigator years ago had demonstrated ST + T wave changes induced by H_2SO_4 in the stomach of 3 pts. and gastric reflux pts. Frey have E

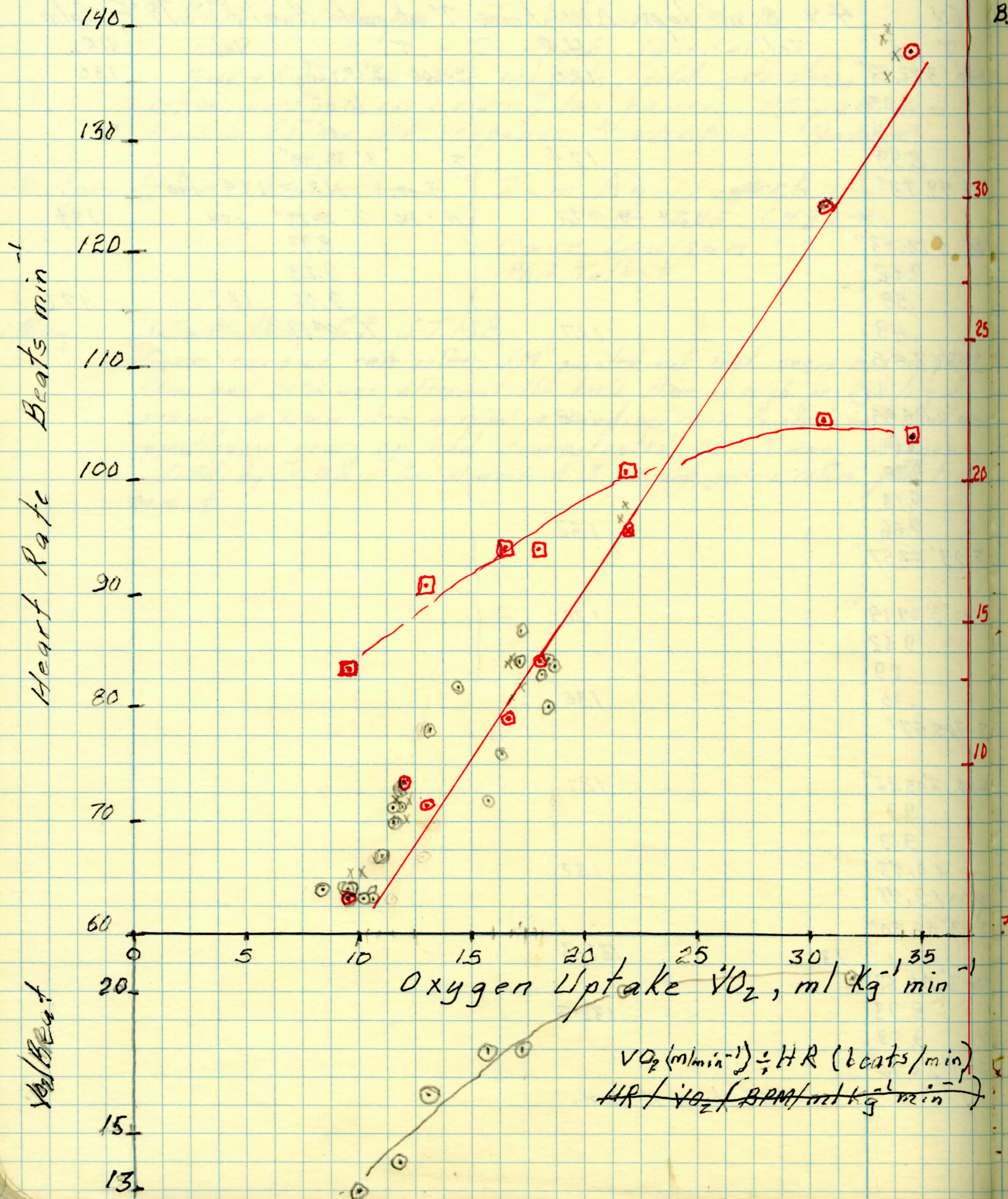
24 Apr. Heart Rate/Time - W.T. at Cow. Crk -

1601 4 X. 8 mi laps. $\Delta 100'$ times T at each .4 mi $\hat{P}$ 74°F, Calm

T sec	Vel.	H.R.	T	Vel.	H.R.
4-300 3'22.58"		120	4-200 3'18.42"		130
9.05			10.0"		
.14			.06"		
8.99		124	Σ 3'38.48"		
Σ 3'49.73"			.4 $\rightarrow$.8 HR $\geq$ 134; $\hat{A}$ 140		
	124 $\rightarrow$ 127		.4-300 2'59.27"	134	134
4-300 3'00.43"			8.93		
9.62			9.29		
.58			9.06	137	137
.49		127	7'04.03"		
Σ 7'17.85					
4-400 2'45.85"		128			
9.6					
9.28					
9.18					
9.66		132			
Σ 3'23.57"					
4-300 3'04.19"		132			
9.62					
.29					
.30		136			
Σ 7'05.67"					
4-600 3'03.82"		127			
9.9					
9.69					
10.43		132			
200' $\rightarrow$ 19.46					
Σ 3'53.30"					
13	122-3				
4-200 3'06.67"					
8.93		132-3			
9.39					
Σ 7'26.76"					

$\sim$ 127 to next meas.

HR vs $\dot{V}O_2$ - W.T. P-81



8 May 96

NASA Flt. Med T.M. - This data & P

$$R(\text{mph}) = \frac{R(\text{ft/sec}) \cdot n}{t(\text{sec})} \cdot 1.466^{-1}$$

$$= \frac{\text{ft.}}{1.466 \cdot n \cdot \text{sec}} \rightarrow 9.78$$

192.5#
BW 87.3#

length, belt 10 ft 52", unloaded

mph	n	secs	R - ft/sec	mph
1.35	n=1	7.12, .25, .15, .11, .23	7.172 sec/Rev. 1.999	1.36
2.	n=1	4.88, .71, .74, .78, .81	4.784	2.04
3.	n=5	15.82, .97, .85, .78	15.855	3.08
4.	5	11.98, .90, 12.00, 12.20	12.02	4.065
5.	5	9.67, .65, .58, .67	9.643	5.067
6.	10	[16.25, .20] - 18.19	18.61	6.023
7.	10	13.84, .68	.77 .76 13.7625	7.101

Stage, mph, Bruce, 195#

I	1.7/10%	27.66, .68	.67 n=5	1.76
II	2.45/12	38.03, .10	.065 n=10	2.56
III	3.4/14	28.10, .10	n=10	3.47

IV	9.06, 28"-8'43.26"	Unloaded ; 22.99, .92	loaded 22.72, 23.02 (12)	→ 4.265
	4.2/16%	" 23.00	.955	→ 4.257

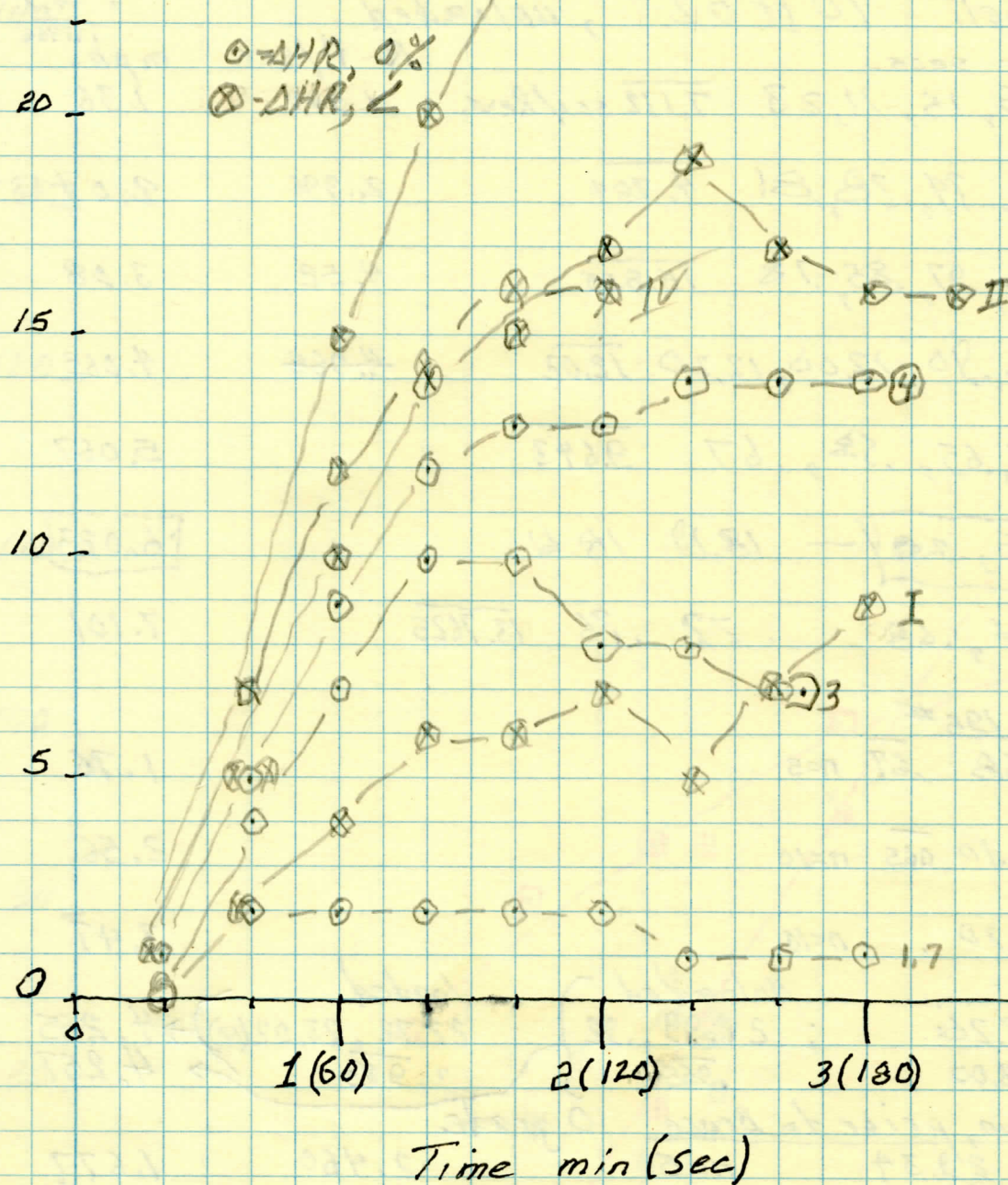
mph	Loaded run, prior to Bruce	n	0 grade	
1.7	28.92, 29.34	n=5	2.460	1.677
	29.13			
3.0	32.31, 32.27	n=10	4.438	3.026
	32.29			
4.0	24.17, 24.12	n=10	5.862	3.997
	24.45			

? TM, 5M
XMarquette MGA, 1100
Metabolic -

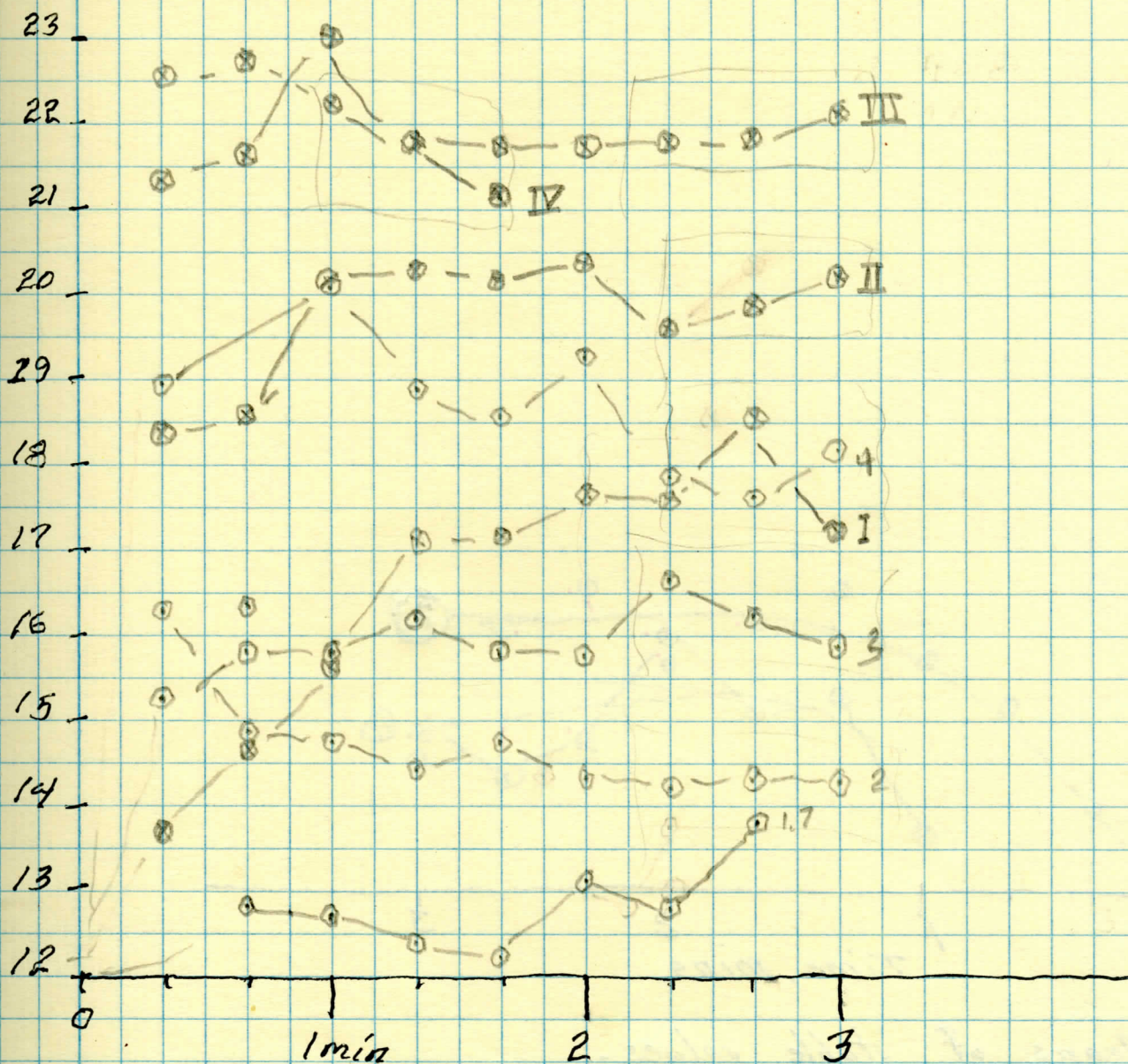
" Case -

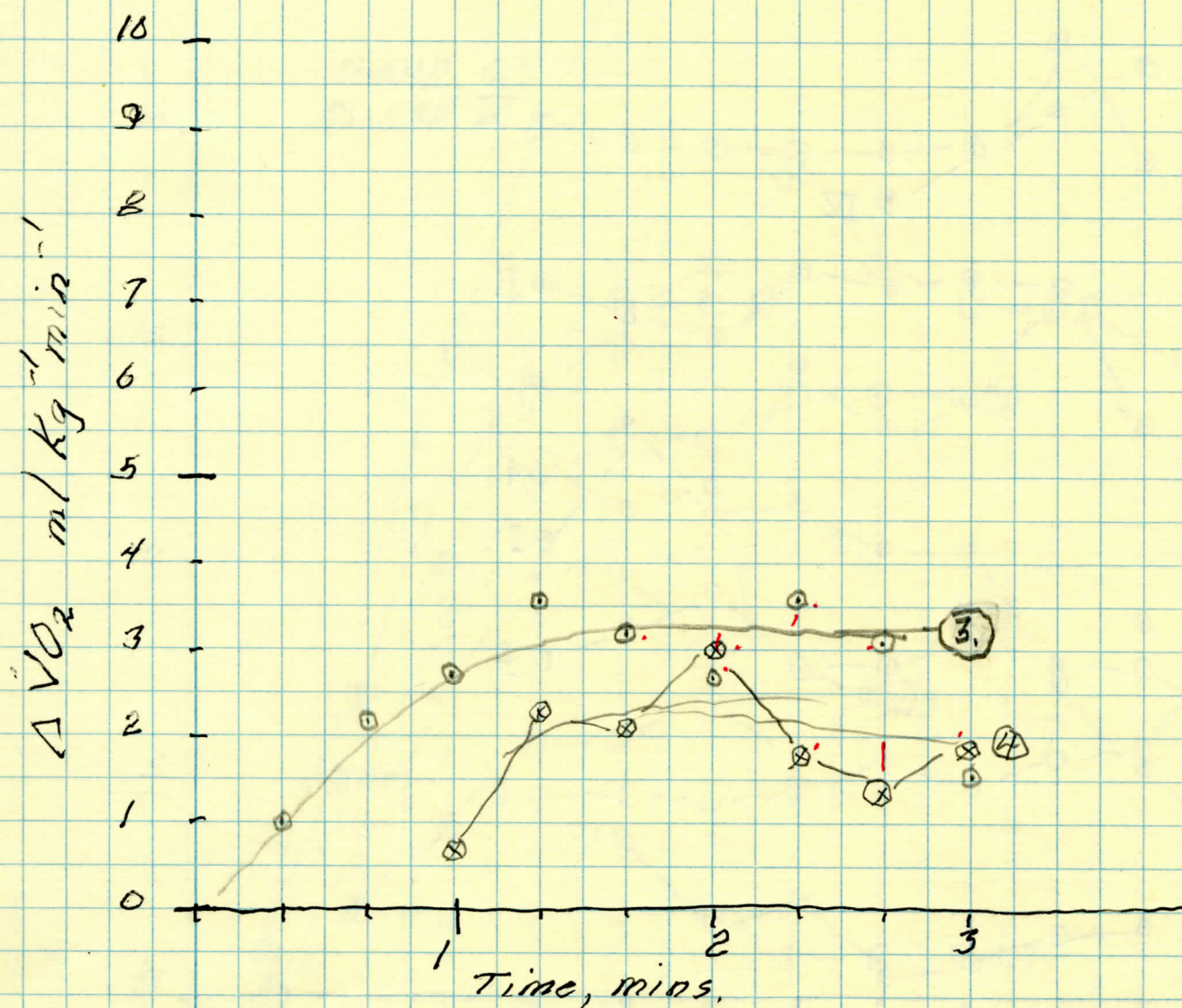
Quinton 1860 -

Interface Assoc. Vent Meas Mod -



8 May HR/VO₂ as F(Time) - P-81



8 May $\Delta \dot{V}O_2$ as $f(\text{time})$ P-81

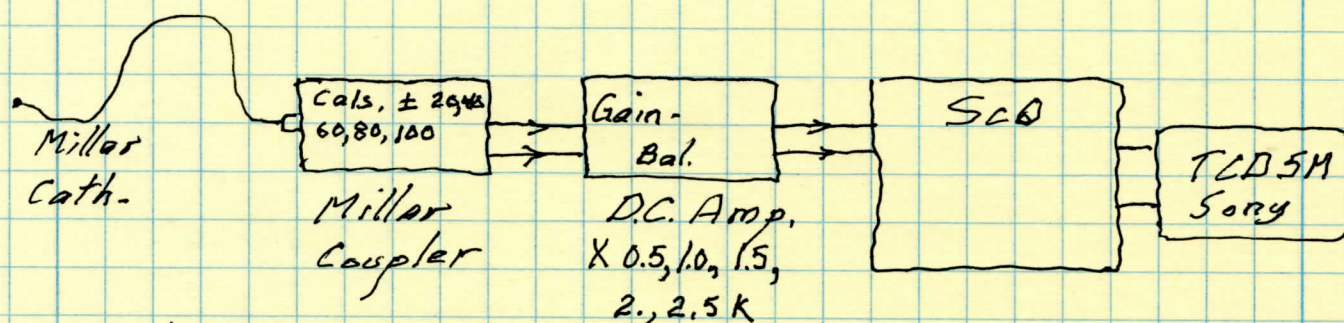
Velocity Means of stable values.

ft/sec	Mph	N	HR BPM	$\dot{V}O_2$ ml/kg/min	$\dot{V}O_2/HR$ ml/beat
2.49	1.7	3	63	9.62	13.27
4.399	3.	4	71.25	13.2	16.14
5.866	4.	4	84.25	18.27	17.69
2.93	2.0	4	73.66	12.08	14.31
I		4	79.-	16.57	16.39 17.78
II		4	98.25	22.80	20.3
III		3	124.	31.29	21.99
IV		3	138.3	34.63	27.71 21.71

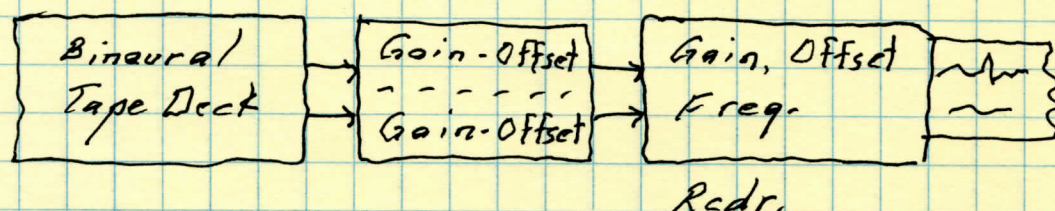
Replay of Intraesophageal-gastric recording.

S. Pool says Gheisen. has rcds. Called Mike who said call Stuart Lee 483-7172; called talked to Alice.

S-8 recording:



Replay



Record ①
10²

Gnd. Study - W.T.

PC-460

Elec Cal.

NB.

Direct
Record.

{ 20 31
40
60 }

mm.
Defl.

Gain 500 - 5 V/cm⁻¹ Sens:

Mech. Cal. PC-350 #4155

Gain 500, 5 V/cm.; Gain 1000,

Em H₂O mm defl. mm defl.

0 -1 0.

5 6 12.5

10 13 26.

15 20 40.

20 26.5 53.

25 33. 66.

30 40. 80.

+20 calib. 35.5 72

+40 ↓ 71.5 (had drifted)

1mm

$X_{cm} = 26.5 \text{ cm}$
 $X_{mm} = 30 \text{ cm}$
34.5 mm 39 mm

X =

Rcdr. Sens 5 V/10 cm = .5 V/cm

PC-460 #460

Gain 1000

Gain 500

mm defl.

mm defl.

0

0

10.5

-

22. 0.455 0.909 11 29

-

34.

-

46. 0.444 0.888 22.5 51

-

57.

-

68.5 ^{Zero} +1 0.882 34. 74

-

63.0 0.438

31.5 64.5

30. X

63.5 +3 74.5

67.5 62

30.5

27.55 cm

34

X = 30

31.5

61.5 74

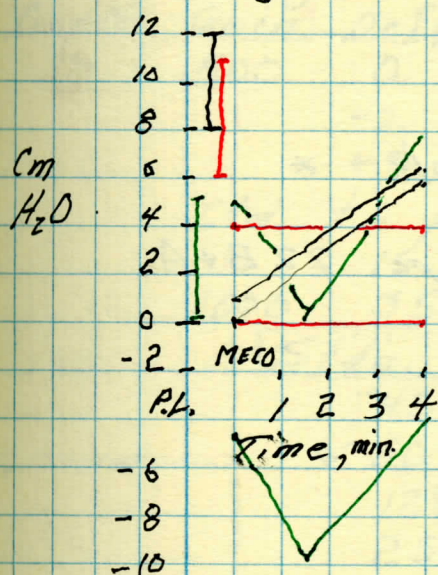
27.79

2493

6 Nov. $\Delta V / \Delta P$ @ Ventricle

Gunnar Blomquist measured @ atrial pressures in H.S. Hearts and found 'zero' entry to $\bar{w}$. Looking at published record, one subj. was not zero and others varied. Cardiac O.P. is not compromised

so a 'problem' of filling pressure exists. First it seems likely that intrathoracic P is also $\downarrow$. Secondly wt. has been removed and I suspect both heart and vessels have intrinsic, small compliance which is overridden by weight on Earth - i.e. the heresy of suction.



19 Nov. 13 Days and much work on the records and literature, later.

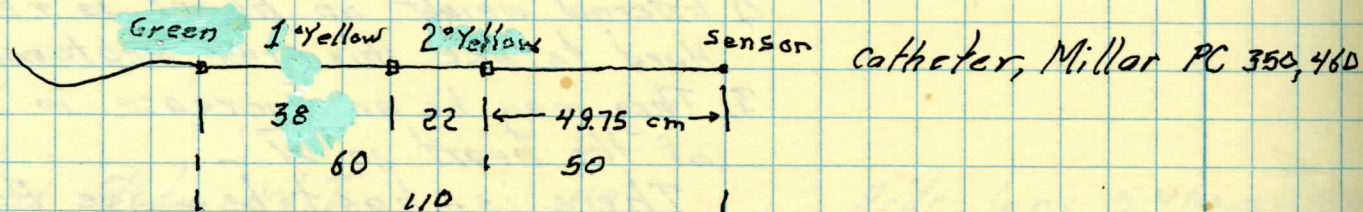
There is little difference between $P_g + \bar{w}$ esophageal pressure while gastric press is $\sim +8$ cm in my case in $\bar{w}$. Bucky et al surmised that:

- 1) Pleural gradient 'should be' abolished in $\bar{w}$ and if my -8 cm H_2O is mean of P_{pl} and the gradient is on the same order then at cardiac level this might be a $+4$ cm. increase.
- 2) External weight on heart is removed - Hard to see this from anatomy -
- 3) They may be an increase in compliance of the heart in $\bar{w}$ -

There is - has to be - See p. 117

6 Nov. Intraesophageal Records

- ① Gould Ink Record - 10 cm 5-8 pre 20 Aug 83
Calibration and catheter in.
- ② Gould Ink Record - 10 cm. Unknown
has catheter in.
- ③ Gould Ink Record - 10 cm. Pull Out & Cals *
- ④ Thermal Record - 16 cm - Replay from tape 22 B+A
Insertion + removal + cals.
- ⑤ Pull out portion of above. Thermal 16 cm.
- ⑥ Copy of inflight tape cassette
- ⑦ Orig. " " " "



7 Nov. 1996 Analysis of Intraesoph. record ①

See Cal., drifts P.100: NB Poll caused ↑ P; 5 45 cm H₂O
Max depth 109.75 cm.

Going in: defl. mm -

Red in Cm H₂O

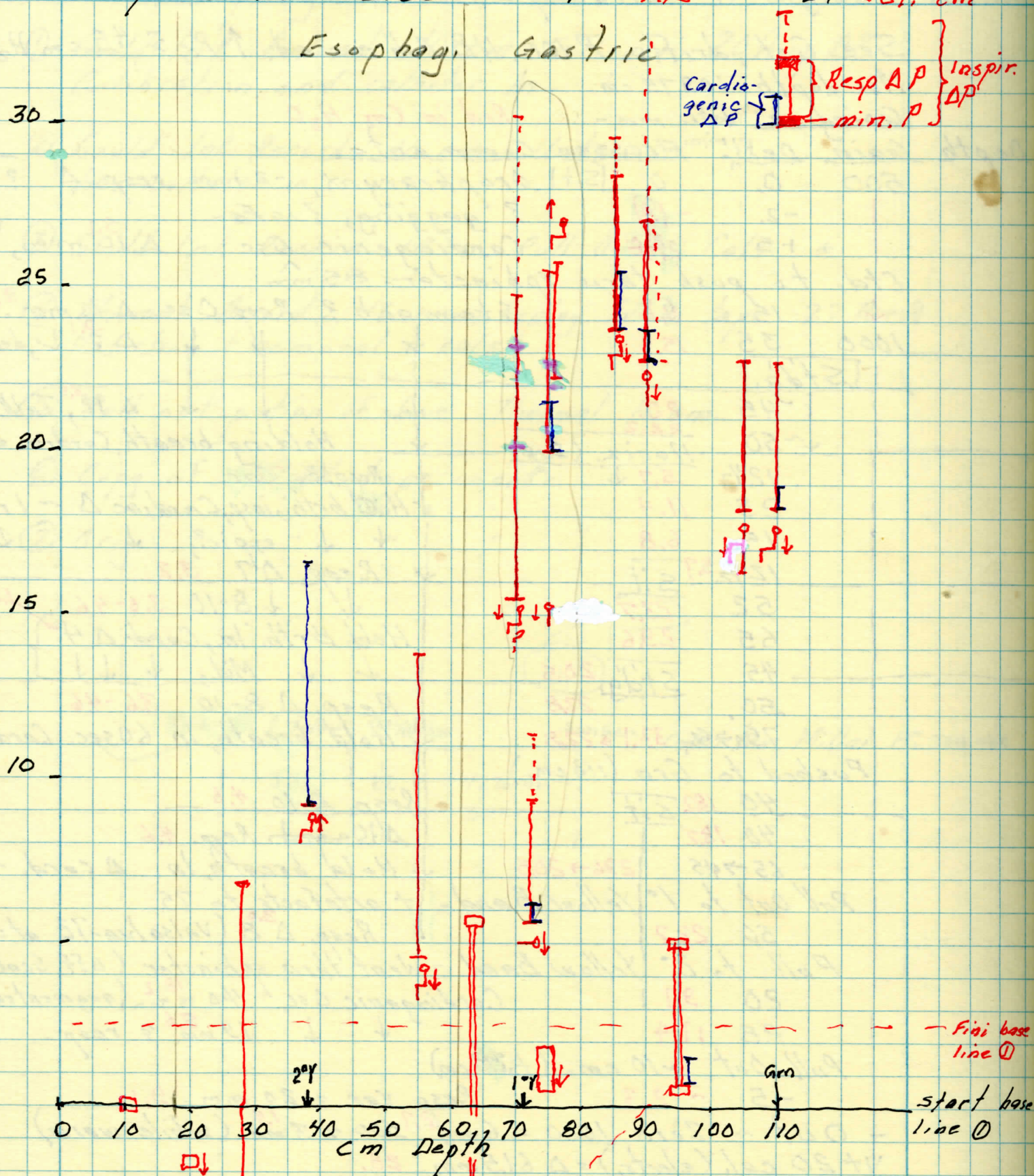
Depth	Gain	Defl. ^{min}	Press ^{min}	Comment	Posn.
0	500	0	0	[Sit] Oropharynx, -2 mm resp. Δ	? 5
		-2	-1.8	? gagging, ? in Es-	
		+5	2.45	Cardiogenic Osc. Δ 10 mm,	Valsalva 65mm
				Ctd. to push thru sphincter = 85 mm	
		15	6.8	Stomach? Resp. Osc. Δ 10 mm.	9.1
		1000	35	Δ 20 ↓, deep Insp 32	14.6
	[Stdg.]				
	45		20.2	Δ 12, Talking	65
	~50			Holding breath, Cardiac ≈ 3 1/2 Δ	1.6 min
	12 1/2		5.7	Resp. Δ 3.6	
	25		11.4	Hold brth, insp, Cardiac Δ ~ 1 mm	0.5
	15		6.8	↓ expir.?	Δ 0.5
	12 1/2		5.7	Resp. Δ 7	3.2
	52		23.7	↓ 8-10	3.6-4.6
	65		29.6	Hold Brth. In., Cardiac Δ 4	1.8
	45			↓ Mid. ↓ ↓ ↓	
	50		22.8	Resp. Δ 8-10	3.6-4.6
	75 → 50		33.1 → 22.8	Hold breath, In. 60 sec. Card. Δ	20.9
	Pushed to Grn. (110 cm.)				
	40		18.2	Resp. Δ 10	4.6
	40		18.2	Δ 10 card, Resp.	4.6
	65 → 45		29.6 → 20.5	Hold breath, In. Δ card, ~ 1 1/2	0.7
	Pull Out to 1° Yellow Band -			+ artefacts to 75	
	50		22.2	Resp. Δ 8 (Valsalva-72 at 500X)	
	Pull to 2° Yellow Band. - Went thru sphincter (off scale) > 100 mm				
	20		9.1	Cardiogenic Osc. 40 mm - (augmented by resp.)	18.2
	25		11.4	↓ 19 mm, 3 resp.	8.6
	Pull Out ~ 10 cm. (to 28 cm)				
	-5		-2.3	Resp var. = 20 mm.	9.1
	Out - Zero 1000 = 6 mm		2.7	500 ≈ 3 mm (while warm)	1.4
	Y+20 cal. (electr.) = Δ 61.5 mm.				28.

Calib.	Cm. H ₂ O	Defl. (1000 gain)	Actual
H ₂ O	0	6 mm - 6	2.7
0	10	28	22
10	20	51	45
20	30	74	68
30			

0.455 Use for ≤ 30 mm
0.444 " " ≥ ↓ ↓
0.441 " " ≥ 70 ↓

Graphic Pressures

Est. Distances Nose to
 Esoph. 7" = 17.8
 Diaph. 24" = 61. cm

Press - Caa H₂O

This plot is from record ① cal + baseline. It does not include ~2.7 cm. base + baseline shift at 100 cm. $\downarrow$ are in, $\uparrow$ are out meas.

7 Nov Pressures, Es-Ga - R: resp. Δ C = cardiac Δ B = baseline

Location	mm def	1	Gain	In	Out
B	ΔR	ΔC	1500		
Stomach	18	≈ 15/4.5	3/1.9		
? Crus	0	≈ 35/10.5	≈ 5/5.3		
p Sphincter	12.0	~ 11/33	~ 5/5.3	1500	
base = 16	-90.0	-18.0	-5.4		
p Gaggling	~ 25	~ 5/2.31	1000		
Upper Eso.	5/231	4/1.4	1000		
Oro Ph.	11	-	-		
Cal.	60Δ	B = 11			
	30Δ	B = 5.5	500		
	90Δ	B = 16	1500		

MD-6 5-8 Record ③ 1-Record zero.

cal + 20 added - 90mm.

Scale -

$$27.7/60 = 0.462$$

$$27.7/30 = 0.923$$

$$27.7/90 = 0.301$$

Record ①
~ 28cm in ~ 37.5 ~ 20 ~ 35 1000 $\Sigma +20 \text{ cal. } (\Delta = 61.5) \text{ zero} = 6.$

$$-61.5 \Delta \begin{matrix} 9.1 \\ 1.6 \end{matrix}$$

$$-24.0 (+6 \text{ baseline}) = -30 \times .455 = -13.7 \text{ cm H}_2\text{O}$$

$$\checkmark \sim 37.5$$

$$-6.61$$

$$31.5 - 61.5 = 30.$$

8 Nov.

Comment on Gastro Esophageal records.

Record ③ was probably made from orig. and is clean but redr. cut off neg. portion -

(cassette)
Record ④ was made from tape 6 a copy of orig. tape ② and was noisy esp. side A. It may be possible to clean this up & ↑ amplitude. Sides A + B ~~are~~ SCO cals. match perfectly but there was a large () zero drift between them. A zero & elec. cal. were done before catheter was pushed in, at gains of 500 & 1000, and a gain of 1000 used initially -

Zero In:	Cal.	Out:	Cal.
X 1000 = 22	65 mm. dt.	X 1000 33.5	65.0 Δ
		X 500 26	32.5 Δ
		X 1500 39	98.5 Δ

SCO - 110 mm

SCO - 110 mm

In:

In a matter of secs. base line ↑ to ~~27~~ 30 and $\bar{c}$ passage fell to 23. Between artefacts it fell ~ 20; at one point 3 motion (?) base was 20 $\bar{c}$ AR ~ 30 & AC ~ 1; $\bar{c}$ advance, pressure B ~ ~~28~~ 18; $\bar{p}$ the sphincter $\bar{c}$ AC ~ 17 to B.L. 35 to 38, Cal. was 27.7 cmH₂O eq. For a factor of .426 cmH₂O mm dt.

Some of the above values $\bar{c}$ 'In' + Out zeros -

Value -	In, A In Out	Out, A Out
30	22, +8/3.4	33.5 - 3.5/-1.5
23	22, +1/0.4	" - 10.5/-4.5
20	22 - 2/-0.8	" - 13.5/-5.8
18	22 - 4/-1.7	" 15.5/-6.6
35-8	22 + 13.16/5.56.8	" + 1.5 + 4.5/+6-1.9

9 Nov.

Base (zero) lines ^(now) are obviously crucial here. There are three sources; Recorder SCO system, D.C. Amp. and transducer - temp. & drift. Critically reviewing these - Record ① - ④ next pg - N.B. temp. shifts can def. be seen on removal and ? on insertion.

9 Nov. Base line - In mm defl. from paper zero -

Record-Gain	Rcdr		SCO		D.C. Amp		Transducer	
	Start	Fin.	S	F	S	F	S	F
500	0.0	+10.75	-	-	-1.0	0.75	3 est	1*
① 1000			-	-	-0.5	1.75	6*	4.5 → 3*
1500			-	-	0.0	3.00		
					2k 0.3	4.0		
					25 K 1	5.		
④ 500			-1 +99		-6 ND		6	
1000					14.5 ND		11.5**	
1500					17. ND		17.*	

** in nares * in air

→ above

① Repeating Pull Out Meas. on ① using end of record ϕ and Cals. Electric Cals. ④

Calib. 0	6							
10	28 - 6	22	.454 cm H ₂ O mm defl.	X	Δ mm			
Gain = 1K	20	50.7 - 6	44.7	.447	0.5K	30	0.906 cm H ₂ O mm defl.	
	30	73.7 - 6	67.7	.443	1.0 K	60	0.453	
Transducer PC.460					1.5 K	90	0.302	
Elec. +20	64.5 - 3	61.5	= 27.2 cm H ₂ O					

Base			Cardiogenic A			Respir. Δ (Sitting)		
{Moving in reverse down track:}								
Locat./Gain	- ϕ =	X Cal. = 6.40	5.	X Cal. = 2.27		22.	X Cal. = 10.0	
Before Oroph.								
1K	20 - 6 = 14	6.4						
28 - 40 cm	~ 40		~ 5	2.3		~ 15	6.8	
+ 20 el. cal/1K	(1) 61.5 A - 6 = -27.5	-12.5						
50 cm	20 - 6 = 14	6.4	20	4.5		45	40.8 20.4	
1K		20	passed sphincter					
72 cm	25 - 6 = 19	8.6	1.5	0.7 1.4		7	3.2 6.4	
0.5K			Valsalva = Δ 65 = 59.					
72 cm	50 → 45 = 44.39	20 - 17.7	2	.9		12	5.4	
1K								
110 cm	37 - 6 = 31	16.8 14.0	4	1.8		12 Normal.	5.4	
1K			N.B. Holding both, insp. 55 fell to 45.			30 deep	13.6	
Stand	37 - 6 = 31	16.8 14.0	1.5	.7		10	4.54	

9 Nov. Data Reduction - Pull Out - S-8 ④ ③

End of record ϕ and Cals. see Pg 107 Unless noted
Repeating Pull Out meas. in rev. order. numbers are mm deflection (chart) from paper base

Location	Base level	Cardio Δ	Respir. Δ
Gain	$-\phi \times \text{Cal} = \text{Cm H}_2\text{O}$	$\times \text{Cal}$	$\times \text{Cal}$
Oroph-	12 - 11.5 = .5	$\times .45 = .2$	-
X1K			
Esoph-	5	-6.5 = -2.9	1 = .45
entry			
?	0 - 2.5C	-11.5 to -9 = -2.6	3 = 1.35
		-4.1	
Pull out A/F	3	-8.5 = -3.8	3 = 1.35
			~ 5 = 2.3
Gag A/F	17 - 11.5 = 5.5	+2.5	6 = 1.8
			6/17 = 7.7
Pull AF	73 - 17 = 90 = -28.5	$\times .3 = 1.5$	12 = 3.6
	90 mm + Cat. = -12.8		
/1.5K	2 - 17 = -15	-6.0	~15 4.5
Sphincter			? -
at Sphinct.	20 - 17 = 3	0.9	20 6.
			? -
Cardia	17 - 17 = 0	0	5 1.5
			25 7.5

Push In - S-8 - Next Pg.

Loc./Gain	1.5K	Push In 1g - below - Use Zero + Cals. Pull Out - 10
Oro Phary.	0 - 3 = -3	$\times .9 = -2.7$
In Esoph.	-4	-7
	-5.	-8
	0.	-3
	5.	+2
sph. or	0	-3
	3	0
Stdg.?	1K	$\$45 * 3 = 42$
	45	42
Insp. + H.Br.	50	47
Sup. rec	12	9
Sit	52	49
Std	50	47

11 Nov. 96 Review of Es/Ga pressure.

Records are noisy, esp. in record. May be low SCO level on replay and positions of transducer as unknown on both in records and 5-8.

- It may be possible to gain (amplitude) of SCO sig. & rerecord
- $\downarrow$ get B. swallow & measure my land marks
- All measured points need review and possibly Matthias can help

Review of data -

Pantalos - T501 - $20 \text{ mmHg} = 16 \text{ mmHg}$ or $1.25 \text{ mmHg} / \text{mm dfl.}$
 $\phi = 23.6 \downarrow$

Pantalos data agrees $\bar{c}$ my abdominal (gastric) values and a separate lg esophageal meas. agrees $\bar{c}$ my lg.

There is a dilemma in my data in that an area of $\sim 10 \text{ cm}$ neg. pr. is present in both records, vs the expected $-2-3 \text{ cm}$. Will make a minute survey and have asked J. Matthias to review.

Pull out

- portion of Out = ϕ time

lg record. $19.255 = 47.5$ 1st Zero

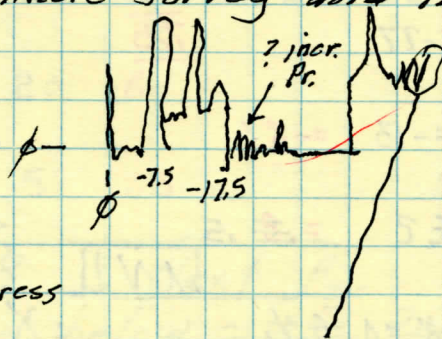
$33.1 = 82.5$ Elec cal

$22.44 = 55.110$ $\text{H}_2\text{O Cal}$ - 0 press

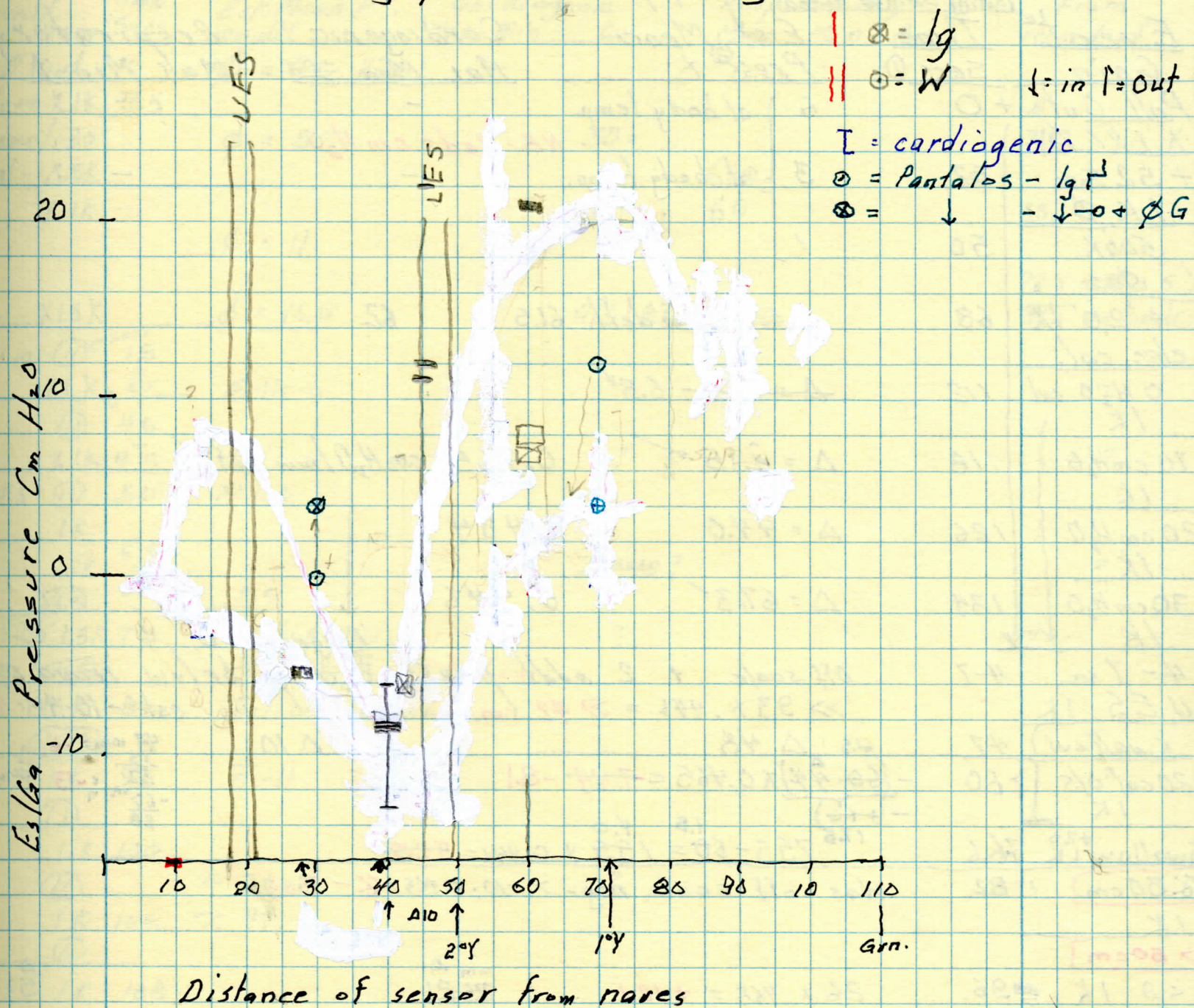
$-3 = -7.5$ to UES (mid)

$-7 = -17.5$ press went neg.

$+20 = -50$ $+20 \text{ cal. (27 cm H}_2\text{O)}$



9 Nov, '96 Pressures during pull out- S-8 1g + MD-6



Side by side comparison of Pull Out - ① S-8 pre-flt.

(sitting unless noted)

Event	Time	Est. Mean	Cardiogenic	Respiratory
Gain	Secs ①	Press X	Max Min Δ	Max Min Δ
Pull Out	+ 0	6 } at body temp.	-	-
X 1 K 1 Ø				
+ 52 Sec	52	3 } at temp.	-	-
1 K Ø				
500 X	50	1 }		
Ø				
+ '20' 1K	68	Δ = 62 mm defl	61.5	62
elec. cal.				
0 H ₂ O cal	112	Δ = 21.5 6.5		
1 K				
10 cm H ₂ O	118	Δ = 21.5	0.465 cm H ₂ O/mm defl.	
1 K				
20 cm H ₂ O	126	Δ = 44.0	0.454	
1 K				
30 cm H ₂ O	134	Δ = 67.3	0.446	
1 K				
4-7 sec.	4-7	Off scale + 2 add peaks	Progressive	
UES 1K		> 93 X, 446 = 42. cm H ₂ O	drop below record zero	est -10.465 4.65
Swallow	47	61.5 Δ 48		
+20 cal 0/5	60	-(60-44) X 0.465 = -7.44 -8.1	Δ = 4.2	47 max = -6. Δ
1 K		-(+16)		13 32 = -13 7-28
Swallow +20	76.6	75.5 - 60 = 15.5 X 0.446 = 34.19		-60 min 28
1 K				
< 50 cm.	82.	Was off scale neg - > -10.0.465 = -4.65		
1 K				
> 50 cm.				
< 9 1K	96.	26 X .465 = +12.1	min Δ 27.5 21	Δ 5
> 110		≈ 25 X .465 ≈ +11.2	min 53-11 = 42	Δ 5
> 120		≈ 50 X .454 ≈ +22.7	Δ 55 = 24.5	min 38-13 = 25 = 11.1
Pull Thru L.E.		Off Scale high > + 41 (30. mm Hg)		
Sphincter 1K				
72 cm 0.5 K	222	27 X .446 = +12.3 X 2 = 24.6		
		Δ Valsalva 75.0.892 = 66.9		
1 K.	222	47 X .446 = +21.		-46
72 cm 1 K Sit/Std.		48/48 X .446 = +21.4		
< 72 cm 1K Lie		12 X .465 = +5.6		

① Zero = exit nose; time is neg; + time is p exit - ② visual est. allowing for waveform - ③ mm defl from Ø NB X 500 Ø = 3

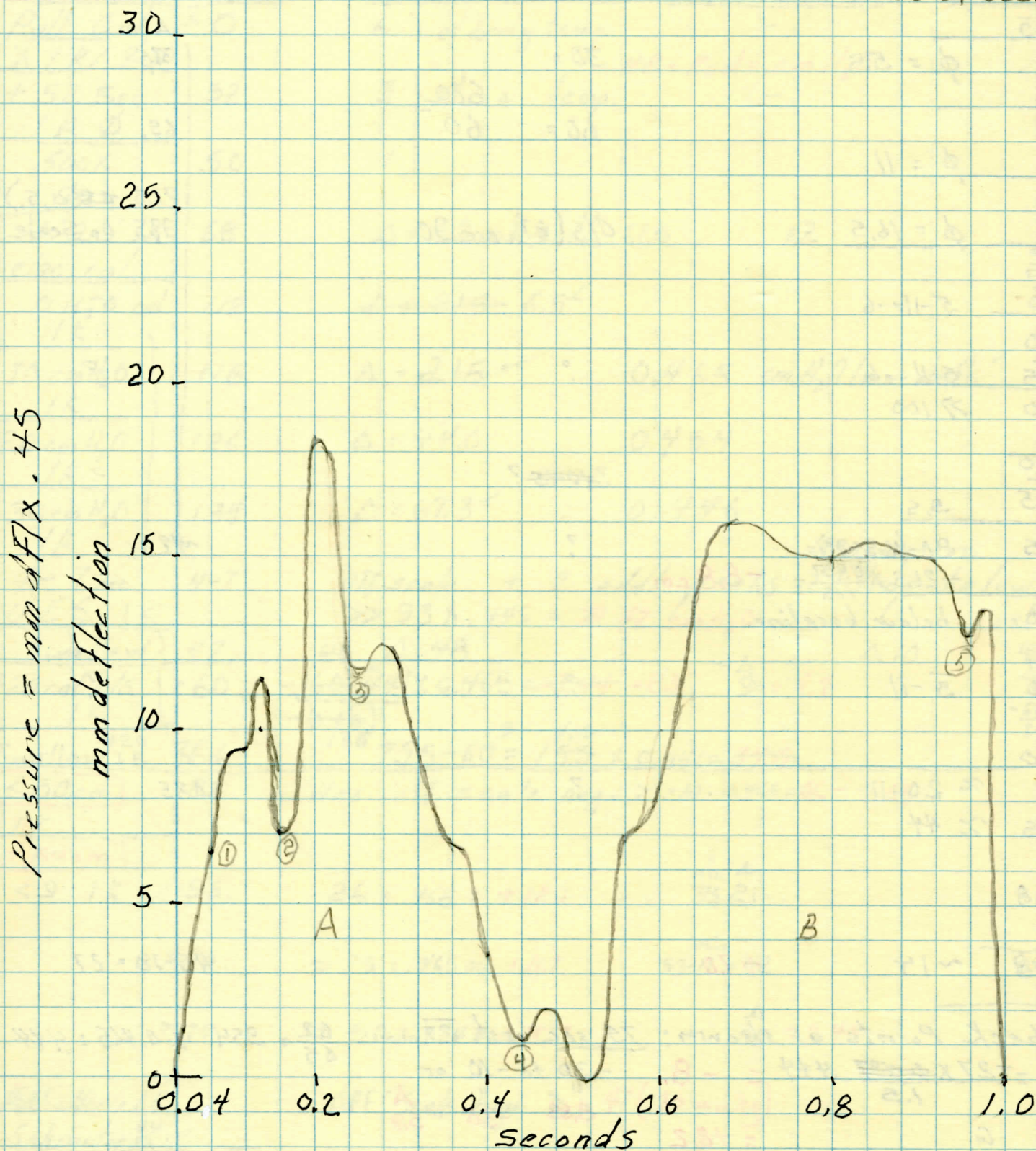
③ S-8 MD-6 Pull Out		Review of accuracy			
Event/Gain	Time Secs	Est. Mean P mm dfl	Cardiogenic Max - Min Δ	Respiratory Max - Min Δ	From record of
Pull Out	0	$\phi = 11\text{mm}$	-	-	-
Zero X 1k	55				A
Zero/t30		$\phi = 5.5$	30 =		32.5
cal - X.5k				620-	
X 1k			60 =	60	65,
		$\phi = 11$			
X 1.5k		$\phi = 16.5$	0/5 (87) use 90		72.5 (0.5) 97.5 on Scale
Going in ⑪ 15					
X 1.5k 20		5-11 = -6	-		-
⑪ 40					
X 1k 45		5-11 = -6	?		?
?UES ⑪ 50		> 100			
1k					
15k 60			?		
⑪ 65		5.5	?		
cal - t20 1.5k 75		80 - (16.5 + 90) =	?		n/2 ✓
⑪ 76.5		$-26.5 \times \frac{0.497}{1.5} = -8.8\text{cm}$			
1.5k 80		below baseline			
⑪ 16.5					
1k 90		5-11	?		?
⑪					
1k 100					
⑪		≈ 20-11	?		135
1k 105		≈ 44			
⑪					
LES? 1k 108					
⑪					
Gastric 1k 118		~ 14	+ 7.0		45-18 = 27
⑪					

check Points as shown: 75 sec est. 27 mm $\frac{62}{85} = .954 \times 0.465 = .444$
 $= -27 \times \frac{.497}{1.5} = -8.8$ -30 to -10 or
 G $= +8.2$ 8.88 -30 A 5.9

Cal- 1g - 20 cm - = $\frac{62}{60} = 1.033 \times \bar{w}$ or 21.5 - .497 cm H₂O/mm dfl.
 1k $\bar{w}$ - " - = 60 44 - .469
 67.3 - .461

16 Nov. 96 Waveforms of Cardiogenic Impulses, S-8 Pre, Out

-96-97 sec.



The above waveshape may be seen as moves through the region above the L.E.S. Incisurae, ⑤, may be valve closure-opening and A is possibly systole and B diastole.

Es/Ga Press

16 Nov '96 Reduction of replay of Tape 22A - Pullback

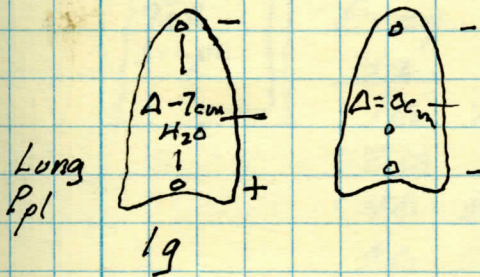
Event/Gain	Time	Est. Mean Pr. defl - $\phi \times \text{cal} = \text{cm H}_2\text{O}$	Cardiogenic Max - Min = Δ
Zero	1000X	ϕ	33
Cal'20' 500X + 10 $\phi = 28$ 33 1000X + 20 $\phi = 33.5$ 65 1500X + 30 $\phi = 39$ 98 Scale Factors $\frac{65}{61.5} = .946$ From ① $\rightarrow$ $465 (21) = .440$ $454 (44) = .430$ $446 (67) = .422$ cm H₂O / mm defl.			
Oroph.	1000X	30	$23 - 33.5 \times .44 = -4.62$
UES	1500X 1000X	90	$\gg \frac{150 \times .44}{1.5} = \frac{66.0}{1.5} = 44.0$
p UES	1500X 1000X	108	$47.5 - 33.5 = 14 = 4.1$ Resp. $\left\{ \begin{array}{l} 38 - 33.5 = 4.5 \cdot .422 = 1.9$ $21 - 33.5 = 12.5 \cdot .422 = 5.3$ 2X min $\swarrow$ 58 max - 33.5 = 24.5 2.2 4/min - 33.5 = 7.5 2.2 58 min - $\Delta = 17.5$ 5.1
p valley peak	1500X	118	$\approx 100 - 33.5 = 66.5 = 19.5$
Valley	1500X	125	$12.5 - 33.5 = -21 = -6.2$ $105 - (33.5 + 98) = 26.5 = -7.8$

Ga 1K 220 50 - 33.5 = 16.5

① system may have limited. Use 98 + offset value

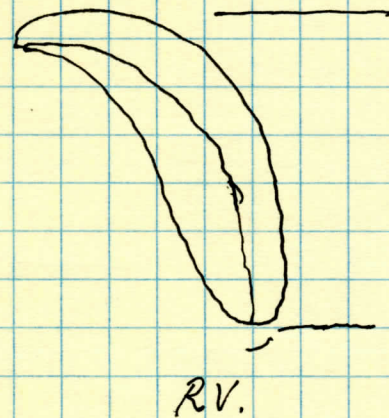
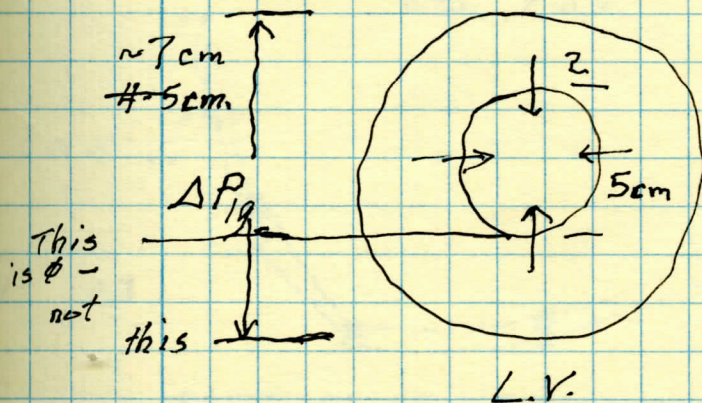
18 Nov. Summary of Ga: Es: (R) heart Filling press.

I'm now satisfied that Es Pr. is little changed in $\bar{w}$; however: the $\sim 8 \text{ cm}$ P_{es} represents $P_{\text{pleur.}}$ over the entire lung for the pleural gradient should not be present. If this were true and if the now increased neg. press. is transmitted to the left ventricle then an increase of $\sim 3-4 \text{ cm H}_2\text{O}$ might be expected. However there are other effects including:



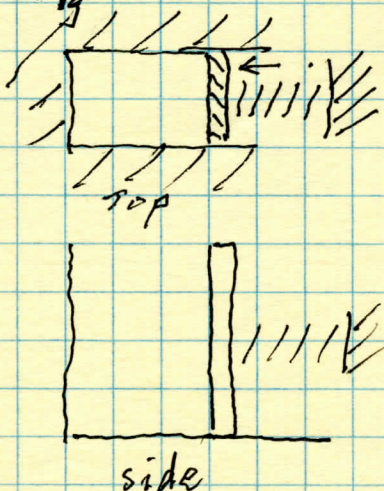
Weight of Extrinsic structure
 " " Heart + blood (Ventricle)
 Increase in Size of thorax
 Change in abdominal ~~contents~~ pressure

Effective Change in Compliance:

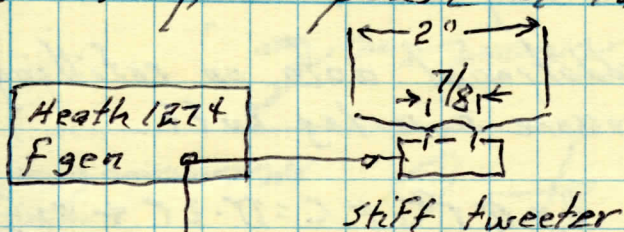


~~AB~~ Compliance is $\frac{\Delta \text{Vol}}{\Delta \text{Press}}$ and in $1g$ $\Delta P = \frac{1}{A} \text{ght} + \frac{p(\text{elastic}(\text{intrin.}))}{B}$

Note that A is dependent only on height! For a given ΔVol in $1g$ the ~~intrinsic~~ ^{total} ΔP_{19} will always be reduced by A i.e. compliance is $\frac{\Delta V}{A+B}$ is less than $\frac{\Delta V}{B}$. Examples and experiments.



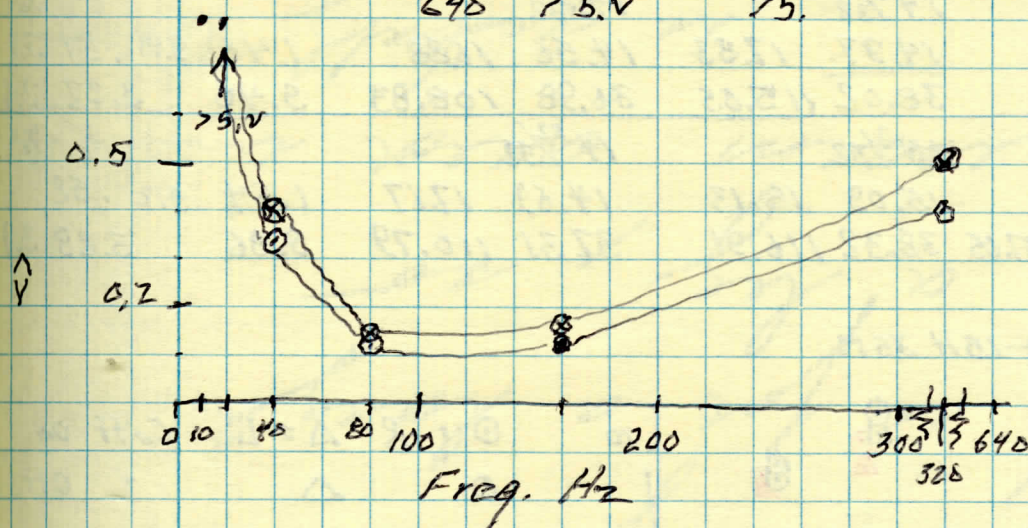
29 Nov. 96 Freq. response of tactile sensation, threshold



① fore
Rest finger lightly on coil;

Perceived max. $\bar{e}$ sweep at $2\hat{V}$:
 ~ 62 Hz - poorly defined

Freq. $\hat{V}$	①	②
Hz.	volt	volt
15	75*	75*
20	$\downarrow$	$\downarrow$
40	4 V	3.6, 4, 3.9
80	.24, .16, .15	.13, .14
160	.16, .16	.12, .13
320	.5, .6	.15, .5, .36
640	75 V	75.



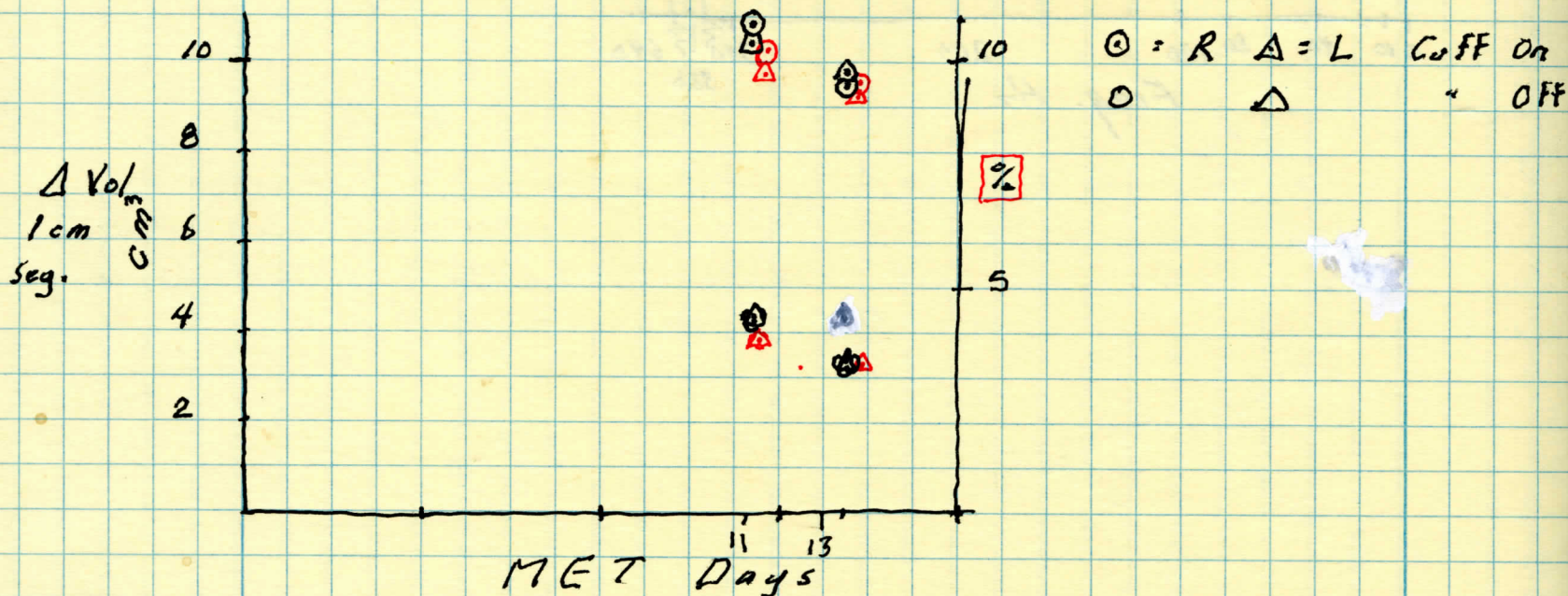
20 Dec. '96 Analysis of Musgrave leg data ST5.

S.M. volunteered to get additional data on refilling legs in W by ↑ venous back pressure & a leg cuff.

Cuff width - 31.5 cm. $A = \pi r^2 + C = \pi \cdot 2r + r = \frac{C}{2\pi}$ $A = \frac{C^2}{4\pi}$

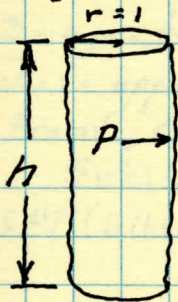
Time, MET			Pre - 40 min →	Cuff On (1)		Cuff Off		$\Delta(1)$	$\Delta(2)$
D	H	M	Circ. in	Area in ²	C	A	C	A	A
11	13	34	14 13/32		15 4/32		14 22/32		%
(R)			14.41	16.51	15.13	18.22	14.69	17.17	1.71 10.2
			cm 36.59	106.55	38.42 17.46		37.3	110.72	10.91 4.17
(L)			14 15/32		15 5/32		14 24/32		%
			14.47	16.66	15.16	18.29	14.75	17.31	1.63 9.25 .65 %
			36.75	107.47	38.50	117.95	37.47	111.70	10.48 4.22 3.9
13	15	35	14 14/32	16.37	14 31/32		14 10/32		%
(R)			14.34		14.97	17.83	14.56	16.88	1.46 9.48 .51 3.1
			36.42	105.57	38.02	115.05	36.98	108.83	9.48 3.27 3.1
(L)			14 14/32		15 3/32		14 22/32		%
			14.44	16.59	15.09	18.13	14.69	17.17	1.54 9.2 .58
			36.68	36.68 107.05	38.32	116.91	37.31	110.79	9.86 3.29 3.1

Time, MET 11D 13H 34M + 13D 15H 35M



Effects of $\bar{W}$ on compliance in vivo

In lg.



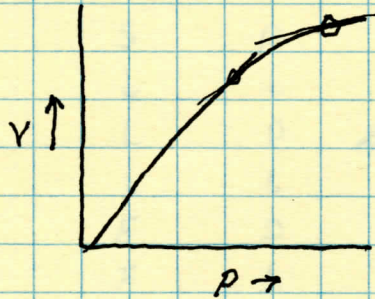
$$\text{Area} = \pi r^2 = \pi 1^2 = \pi$$

$$\text{Vol} = Ah = \pi h$$

$$\star \text{ Press} = dgh$$

For a rigid tube: Compliance = $\Delta \text{Vol} / \Delta \text{Press}$,
and is a function of g, A

$$\frac{\Delta \text{Vol}}{\Delta \text{Press}}$$



Review of SL-3 IR Photos

Subjects are apparently p fth. in LBNP - Most are a series of 2 shots, apparently in different lighting or exposure, of head and shoulders front, side and then calf. (F, S, L)

Photo #	Subj.	View	Expos	Commentary
MS 001	SPT (Gibson)	F		
3	↓	S	D	
4	↓	↓	L	
5	↓	L	D	Band CY 36 13-14 Hard to distinguish vv.
6	↓	L	L	
7	↓	F	D	
8	↓	F	L	
9	↓	S	D	
10	↓	S	L	
11	Pit. (Pogue)	L	D	Two v. prom. vv. Band CY 36 13-14 ↓
12	↓	L	L	
13	↓	F	D	
14	↓	F	L	
15	↓	S	D	
16	↓	S	L	
17		L		Band B? D? E 36 12-13
18		L		
19	Pit (Pogue)	F	L?	
20		F	P?	
21		S	D	
22		S	L	Lgc forehead vv