

29

A

COMPUTATION NOTE BOOK



43-648

Made in U.S.A.

Course BP-III Thornton

Name NASA JSC

Houston, TX 77058

Dallas, S.W. Med. School 8-14 Feb. '81

Dr. D.C. Fixler, Dept. Pediatrics (Ch. Ped. Card) 5323 Harry Hine Blvd.
S.W. Med. School, Dallas, TX 75235 has a pop.
of students, H.S., that he has followed, up to five years &
a variety of non-invasive studies & 'proven' hypertensives,
borderlines & controls. 1979

Dr. H. brought TRS 80 plus two recorders, and Jeanne
to Dallas. I borrowed two recorders from B.D.M. & promise
to compare original gain level & modified (increased)
level in current production. In addition - Terry
had a new P III plus
two units borrowed from an affiliated St. Louis ofc. all purchased
toward a "Halter" B.P. service.

A variety of technical problems occurred including:

Battery Failures

Otd fully chgd. batt S.N. 688 failed $\bar{p}$ ~180 cycles in SN 236 & lge. cuff.
New unused battery chgd - 3+ hrs. & failed $\bar{p}$ 85 cycles in 214 & std cuff.
BPR-241 & lge. cuff ~135 ~

Transducer Failures

SN defective on installation

SN 836 would not record repl. & 1660 and moved to mid arm

Memory Failures

BPR S.N. 256 stored one line only and refused to accept data on
attempts to reload it. Left sit 12+ hrs. & fresh battery and unit
worked normally

BRR SN 212 refused to accept data into memory after a
normal 24 hr. cycle in spite of repeated resets and attempts. Let
sit & fresh main battery for ~8 hr. and ^{then} operated normally.

BPR's - St. Louis

SN ? & ? never used were intermittent

This group of young + vigorous students did not fall at night as do the older population - eg.

18 Y0 140 ± 5' 8" B ♂ had DBP of ~ 60 during day & 65 night
 corresponding SBP of 115 + ~ 105 - (possibly doesn't need to fall)

18 Y0 208 ± 5' 8" B ♂ - last record

19 Y0 185 ± 5' 9" W ♂ 24H 136/74

Work 141/74

Sleep 130/71



Normal vs High Gain Modification

BPR's SN 212 + 214 had been modified to orig. gain level vs. all others which had gain increased to prevent record loss $\bar{c}$ sleep.

1. Comparison of performance $\bar{c}$ sleep.

Date	BPR	Xducer	Comment	
12	214	1463	lost ~ 50% of sleep	Gain H
14	214	?	" ~ 80% " " "	
10	212	1568	" ~ 50% " "	
10	241	1624	" ~ 1 1/2 Hr " " large cuff	H Gain
12	241	?	" ~ 50% " "	N
14	256	1082	" 100% " " " "	

Number of attempted records.

212 214 241 256 236
 |||| (5) |||| (5) |||| (6) || ~~||~~ (4)

(1) $\nwarrow$ memory failed on 1 attempt - No data

No significant difference between Lo 3 of 10 vs. Hi

3 of 11 in failures to record sleep.

NB gain low on 241 x1

" " " " 236 x2

" " high " 214 x1

If low set, on these is equiv. to norm. gain on low gain units then numbers should be adj. Conversely if high set on low units is equiv. to norm. on high " this should be recounted.

High Gain	Low Gain	S.N.	Change Gain
	5	212	
2	4	214	H-2
2	2	236	L-2 1
5	1	241	L-1 H2
1		256	
10	12		

Attempt to show

Aus vs BPR

All on T. Parks & TD 1664

SN	<u>S</u>	<u>A</u>	<u>D</u>	<u>A</u>
	Aus	BPR	A	B
214	126	123 -3	83	83 0
	123	123 0	84	74 -10
	120	119 -1	80	80 0
	90	94+4	54	54 0
		0/2.9		-2.5/5.
212	125	125 0	75	77 +2
	124	125+1	78	77 -1
	119	121+2	72	77 -5
	116	119+3	68	69 +1
		+2/1.3		-0.75/3.1
		(+1./2.1)		(-1.6/4.1)
236	119	119 0	78	80 +2
	117	117 0	72	76 -1
	116	117+1	70	73 +3
		+0.33/0.6		+1.33/2.1
241	118	118 0	80	84 +4
	116	124 +8	75	78 +3
	129	125-4	76	80 -4
	124	119-5	80	80 0
		-0.25/5.9		+0.75/3.6
		(+0.4/3.2)		(1.0/2.8)

Comparison of Hi & Lo Gain BPRs at Calib.

BPR SN

Apply Remove
stand sit Lie stand sit Lie
S D BP S D S D S D S D S D

 $\Delta/\overline{SD}$

214 (10th)_L -1.7/3.2 -2.3/2.1 -3.7/5.0 -7/3.0 0.2/6.1 3/4.9 -2.2/2.8 +6.8/7.2 1.7/1.2 6.5/9.2 -3.2/2.6 8/11.5

(8th)_{RS} -2.2/2.9 -1.2/4.3 -1.3/1.7 -1/5.1 ND - -2.3/1.2 -1.66/2.1 -3.7/1.6 -1/1.1 0/2.6 -1.33/2.1
-8.5/6.6 +3.3/2.4 -10.7/7.8 10/9.6 -8.25/5.4 -2.5/5.4

(9th)_{SA} -4.1/1.7 2/1 -3.66/1.15 -3.7/4.7 -4.35/1.5 -5.3/6.4

Gain { (11th)_{KD} -1.3/1.5 2/4.6 -4.7/6.1 3.3/1.5 -2.3/2.1 -6/7 ND (Fail)
H { (12th)_{KD} 6.3/6.2 2/6.9 0.8/6.8 1/1.8 -10/5 9.3/7.2 4.7/1.1 -0.7/1.5 -2.8/4.5 0/3.2 0.8/2.6 2.8/6.6

→ S D

Mean Δ -0.58 1.42 -1.05 -0.22 -4.16 -1.75 -1.58 1.86 -3.88 3.88 -2.61 4.06 -2.31 1.54

SD Mean 3.98 1.47 3.39 2.58 4.27 7.12 5.46 3.85 5.27 4.09 5.66 1.49 2.27

Mean σ 3.22 3.78 4.15 3.20 2.80 6.38 5.40 3.00 2.32 5.75 3.30 6.40

SD of σ 2.13 2.3 2.57 1.61 1.53 1.04 4.36 2.79 3.13 4.31 1.40 3.90

212 (8th)_L 0.66 -6.33 -0.66 -3.66 ND 0 6.8 1.1 4.7 1.1 1.7 13.2
2.08 2.08 0.57 2.31 1.4 6.6 3.1 2.1 0 4.9

(10th)_S -13.5 1.66 -19 4 -11. +9.5
3.53 6.51

(11) $\checkmark$ 0.5 -8.4 .33 5.0 0.5 3.0 1.0 11. -9.8 1.8 -5 8
2.1 7.3 .58 5.57 2.52 5.1 3.4 6.6 5.0 5.2 .6 2.9

(12th)_R 4.3 -2.7 1.0 -4.6 .33 -1.7 -7 -1. 2.3 -2.7 6.0 -4.6
4.9 2.5 1.9 5.4 1.1 9.6 2.1 4. 3.1 1.5 3.8 3.9

(13)_{DR} 3.0 -6.0 -4.3 -4. 8.7 -1. Unit Failed
2.6 2.7 5.1 2.2 1.2 5.6

Mean Δ 2.13 -5.85 -.91 -1.82 3.18 0.10 0.10 5.6 -2.17 1.27 2.17 1.7

Δ , S.D. 1.84 2.35 4.55 4.78 2.54 .85 6.09 6.64 3.73 3.40 6.3

Mean σ 2.92 3.64 2.04 3.87 1.61 6.57

σ , σ 1.34 2.45 2.13 1.87 0.79 2.63

Date	BPR	Sens.	Cuff.	Xducer	Battery	Comments	Results
8	214	N	L	1624	321		good
9	214	N	N	1463	?		good
10	214	N	N	1543	598		good
11	214	H			505	- new batt., charged	

Summary of A B O Study at S. H. Med. School, Dallas 8th - 14th Feb.

Medical Goal - To obtain 24 B.P. records of 11 hypertensive male juveniles, 17-19 Y.O., and a matched cohort, all intensively studied up to 5 years by Dr. Fixler, Ch. Pediatric Cardiology.

Technical goal - to compare PTH's $\bar{c}$ increased gain to those older gain settings.

Equipment

P-111s;

SN: 212	}	supplied by DMA $\bar{c}$ original gain settings	}	designated LO
214				
236	}	UTMB, modified to increase gain	}	designated HI
241				
256	}	units on loan to scanning svc.	}	
?				
?				
		latest production		

2 ea 1970's

UTMB TRS 80

Personnel - Thornton, Wallace, H's technician, F's technician and Terry? (scanning svc.)

Facilities - large lab $\bar{c}$ excellent support - Very well arranged schedule, totally supported

Procedures - Either T or W installed and calibrated all BPR's and confirmed operation $\bar{c}$ 1979 playback. Checked, by phone, all subjects at least once and went to homes in event of suspected malfunction. Two teams $\bar{c}$ complete equipment including 1979's went to two schools with 2 subjs. / school typical. Immediate replay $\bar{c}$ 1979 + then analysis by TRS-80.

Medical Results - 21 partial or complete records out of 23 final attempts - (2 repeats) - records now in analysis

S.H. study results, cont'd.

Technical results:

General - numerous failures, many old friends some new
 Pressures were highly variable (in this population)
 $\bar{c}$ good to excellent sys. sounds and good to poorly
 defined ^{diastolic} sounds i.e. extended transition from phase IV to I
 $\bar{c}$ high S & low DBP, many large muscular arms.

Failures - summary

Straps - 5 metal strap to BPR studs ^{survived} failed
 1 strap stud (SN-214)

Batteries -

failed after 135 cycles } large cuff. used, fully chgd. 12+ hrs.
 " " 130 cycles }
 " " 85 " std. cuff new, 3+ hrs. chg.

Memories -

SN-256 stored only 1 line, operated & calib (on & off) normally - N.B. would not load data $\bar{c}$ fresh battery but functioned normally after sitting in Stby-24 hrs. $\bar{c}$ fresh battery
 SN-212 refused to accept data in memory after a normal run - left $\bar{c}$ battery for 24 hrs. and then functioned normally
 SN-___ + ___ (shipped from St. Louis) both refused to calibrate properly and to store data when first tried $\bar{c}$ freshly charged battery - functioned normally after 24 hrs. $\bar{c}$ battery in & on Stby -

Transducers

minimum of 6 failures on installation - either refusal to record any value or only record a narrow (10-20 mm.) pulse pressure in mid range - All recorded normally after a minimum rest period of 24 hrs.

Sleep drop out failures -

This was complicated by necessity of setting LO units to high sens. twice (recorded as high gain units) and HI units to low sens. three times (treated as LO units) and HI unit to high sens once (treated as HI unit)

S.H. study results contd.

Sleep failures, summary:

Attempts (final)

High Gain	Low Gain	SN	see prev. note on gain designation + setting
	5	212	
2	4	214	
2	2	236	
5	1	241	
<u>1</u>		256	
10	12		

Sleep Records Lost

Date	BPR	Xducer	Comment	Sens.	Cuff
12	214	1463	~50% lost	H	Std.
14	214	?	~80% "	N	"
10	212	1568	~50% "	N	"
10	241	1624	~1 1/2 Hr. "	H	Large
12	241	?	~50% "	N	"
14	256	1082	100% "	N	"

Failures - LO - 2 HI - 4

% Fail LO - 16 HI - 40

Calib. Error.

It was necessary to increase gain to H on 2 of 10 attempts to LO gain units and to decrease gain to L on 3 of 11 attempts to H1 gain units - NB it was necessary to increase gain on 2 of 11 attempts to record to H1 gain units and this still lost a portion of the sleep record

Results from the above modified gains are not included in the following data:-

S. St. study results, cont'd.

Calib. HI vs LO cont'd.

Comparison on same subject & excellent sounds and sharp end points - 4 trials ea. unit.

Auscultatory readings taken as std., same X'ducer. & observer

S.N.	Mean Error / Std. Dev.	mm Hg.
	<u>SBP</u>	<u>DBP</u>
LO { 214	0/2.9	-2.5/5.
212	+2/1.3	-0.8/3.1
Mean	1/2.1	-1.7/4.1

HI { 236	+0.3/0.6	+1.3/2.1
246	-0.3/5.9	+0.8/3.6
	0/3.3	1.3/2.9

difference probably not significant

Date	(mmHg)	Apply	Remove	Δ	
S.N.	Mean error	of 3 passes (9 trials)	ASBP	DBP	
10	214	-1.8/	+3.3/	-0.5/ +1.3	+7.1/ +3.8
8	214	-1.8/	-2.3/	-2.0/ -2	-1.3/ +1.
9	214	-4.0/	-2.3/	-9.2/ -5.2	+4.1/ +6.4
Mean	-2.5	-0.4	-3.9	+4.1	
8	212	0/	-5/	0.7/ +7	+4.3/ +9.3
11	212	+0.4/	-0.1/	-3.1/ -3.5	+6.9/ +7.0
12	212	+1.9/	-3./	+0.9/ -1.	-2.8/ +2
13	212	+2.8/	-3.7/	-*	-*
Mean	+1.7	-3.9	-0.5 -7.9	+2.8	21.7
Tot. Mean of LO units	-8/	-2.0/			

* unit failed

S.W. study results cont'd.
Calibr HI vs LO cont'd.

Date	S.N.	Apply		Remove			
		SBP	DBP	Δ SBP	SBP	DBP	Δ DBP
	241	+0.5/	+0.5/		+1.5/	-3/	
10	241	-0.4/	-0.4/		— *	— *	
11	241	0/	3.7/	-5.7	-5.7/	+3.1/	- .6
Mean		-0.2	+1.7/		-5.7	+3.1	
9	236	-2.2/	-4.4/	+5	-1.7/	0/	+4.4
11	236	-6./	+2.4/	+3	-5.7/	-1.3	+4.4
12	236	-4.3/	-3.5/	+5.2	+0.9/	+2.3	+1.6
Mean		-4.	-1.8	.3	-2.3	+0.3	+9.8
				-7.2			27.7
				-7.6			37.5
Tot. Mean of HI Units		-2.5	-0.4	-7.6	-3.1	+1.3	+3.75
Tot Mean all-		-1.5	-1.3		-1.5	+2.2	-1.76
							4.51

Concl: First see DMA memo ENG 72-81 which describes what I found on trying to reconcile above data & supposed changes in gain. I concur entirely with his wondering why the error was not detected by functional tests which I also found to be inconsistent. In short the intent of the technical test was aborted by errors which resulted in no difference between HI & LO units.

The primary and more important result of the test is a demonstration of the problems we encountered and which were discussed & you.

The system is not ready for general use for the following reasons -

1. It is unreliable - see the problems noted.

2. Several small additions prevent this from being a usable system for any but the researcher using P111's & the 1981.

BDM -

Reliability - Design
Execution{ Calib. - Memory
Transd.

Design {

MD

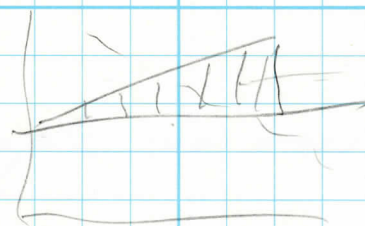
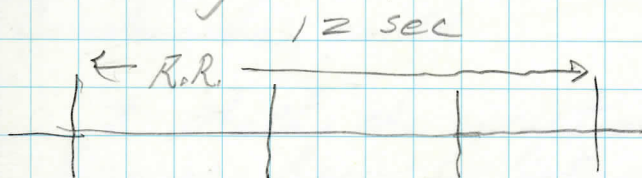
Education

cardiodynamics -

$$\begin{array}{r}
 242 \\
 205 \\
 1279 \\
 \hline
 5612703 \\
 44102 \\
 \hline
 2240490
 \end{array}$$

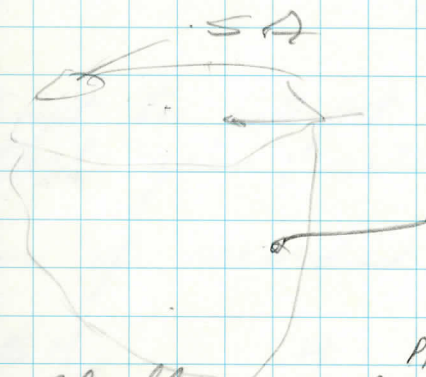
Organization -

San Diego



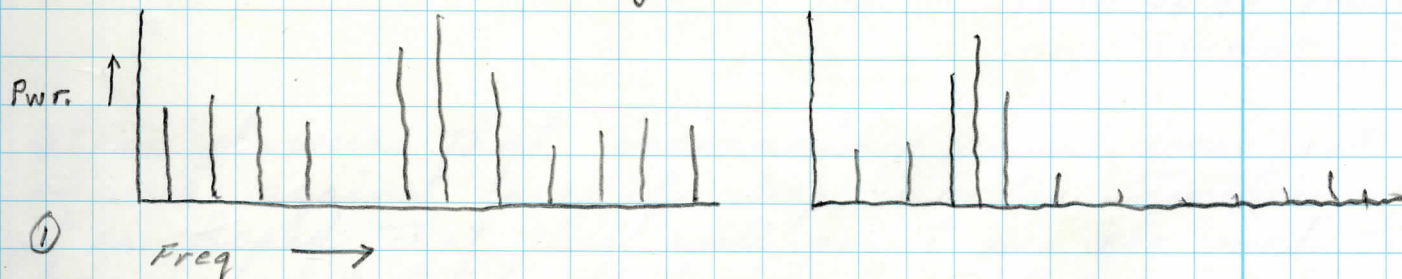
R.R. 12 sec

Does Fourier Analysis - of 12 sec. epochs -



PHD - Biological Psychology

Dr. Blackburn, $\bar{p}$ Doc. $\bar{c}$ 2 yr. fellowship at U.C. La Jolla from U. OK was working $\bar{c}$ Dr. Psych. on enzyme changes ^{tyrosine etc.} in psch. They looked at H.R. variations in pts. & then in psch./cardiac pts. and found cyclic rates of change in cardiac related to incidence of arrhythmias. His current procedures: using tapes from 445 recorders a single channel real time std. EKG tape is generated. He takes the mean R-R interval for 12 secs. for 8 mins (40 samples) and then performs a Fourier analysis. He finds that there is a dominant freq. range but a wide range of freqs. above and below in normal pts - including sleep. Cardiac pts show a more



restricted range of freqs. and much less scatter of power. The same is true of the individual pt. who appears normal when he is $\bar{c}$ arrhythmias ① but looks like ② when he has arrhythmias. Recommended BDM support the work $\bar{c}$ loan of decent automatic equipment which would automatically determine R-R epochs & arrhythmias as well as do F. series. C.B. suggested putting the F. epochs as is done $\bar{c}$ EEG.

S.H. study results, cont'd.
Conclusions, cont'd.

3. With the exception of ~ 6 people no one knows how to interpret the results

4. The scanning services don't have any idea how to use the equipment and labor under a load of sales misinformation.

Attempt to interpret results of units in terms of actual gain; noted as H (high) N (normal) L (low)

No. of records

SN	H	N	L
212		5	
214	2	4	
236		2	2
241	2	2	2
256		1	
	4	14	4
No of sleep failures	2	3	0
% of sleep failures	50%	21%	0%

Samples are too small to be truly significant -

It is obvious that increasing gain does not insure against loss of sleep records. Further it is hoped that this will point up the need to know what total effect changes will have before instituting them i.e. the gain change should not be done before testing more rigorous than Mac can perform -

N.B. Comparison of installation and removal calibrations offer still more evidence for fatigue effects in the transducer. Note that the cumulative means show the DBP calibrations to have risen a mean of + 3.75 mm Hg. and SBP to have fallen - 7.6 mm Hg for a total pulse pressure error of - 4.5 mm

S. 9. Study results, cont'd.

Although this may seem a small change it is highly significant under the circumstances. Individual transducer drifts show much larger drifts eg. on the ninth BPR 214 had a ΔSBP of -5.2 & ΔDBP of $+6.4$ and on the eleventh SN 212 had a ΔSP of -3.5 and ΔDBP of $+7.0$. Again this is a characteristic of the fatigue we see.

Sheps, Mayo

87 507 284 2511
725 4242

P11 and P111, 80% yield, 10 pts wk $\approx$
400+ records - doing drug study. Sunday
B Blocker

Pickering, N.Y.

P11 and starting P111 - ~150 records
and 2 papers

Gifford, Cleveland Clinic

~60 records

87 216-444-6764

Heber, Michael

87 213 498 6892

Frohlich

Ochsnes Clinic, N.O.

87 682 2611

504 838 3930

Hallace

Harold
Hal

Kennedy, Mem. Hosp. Med. Ctr., PO Box 1428.
2801 Atlantic Ave L B CA 90806
213-595-2477 or 595-2163

Mallion

Mac

Scanning rep

Cliff Sanct.

11 Mar A.B.P. implementation problems

In the absence of any real progress at D.M. I decided to call several users of the equipment and discuss my feelings.

Called Terry Hart at 9dalter and she has done no further work

Returned Pickering's call and he was requesting technical aid for interfacing computer to PTH. Agreed to give what I can. Then he listened to his current status & his PTH - has ~ 150 records and promised to send two M/S. He agrees that a meeting of users is most appropriate to examine current status, set tentative standards, etc.

Wallace - felt that a meeting (ABP Working Group) would be an excellent idea and suggested BDM should be interested in supporting it!

Sheps - reviewed his status and discussed problems and ABPWG & him. He also agreed

BDM - he was enthusiastic about idea and almost insisted on supporting!!! even to bringing Mallion over - his concerns were that it have everyone including Mac's bro. & Kennedy, etc. Pointed out that he would have to be absolutely hands off & only pay the travel & other expenses - no stipends. Agreed to continue contacts and explore plan.

Goal: to organize a group & experience in ABP who would generate documents on: Reliability - document problems, make recommendation to mfr.

Design - recommend mods & improvements for future

Medical Standards - establish norms.

Recommended usage.

This might also be a cadre or nucleus for the future - its purpose is to try to arrange an orderly implementation of the technique and to pass on experience.

Gifford agrees it is a good idea, would be willing to participate but should be in fall.

Frohlich approved of the idea and will raise the question of early publication by A.C.S.

~~Apparently~~ Called BDM who was somewhat more cautious
N.B. Get the money in hand before commitment

Called Jack Sevier 486-2170 who ~~says~~ says Lunar-Planetary Institute is made available & is cost.

16 Mar

Called to Jack H. who was enthusiastic (?).

General plan is to organize a two day working group to produce a draft for early publication on ambulatory B.P. This should be done prior to June 1 & vacation.

24 Mar. Mtg. c H. in which it was agreed that we would send out draft letter under UTMB cover. Discussed various aspects.

25 Call to H.K. who was also enthusiastic. Wanted to limit mtg. to those who had considerable experience.

7 -	Typing	\$ 700
16 May	Room	50 + L + B
		50 ea

- CME - Hot redt - 13 Mar
1. Pharmacology - starts Oct - 4 days wk.
 2. Individual - Betty Hms.
 3. Kansas - computer -

Goodman Gilman

Future -

Immunology

10 Apr. Notes on launch

Initially scheduled for 0610 CST but a glitch was found in the fuel cell which was followed by the BBS indicating problems in and dropping of strings 1 & 3, who part of the systems which it must monitor to remain current in event of takeover. This had apparently happened once in SAIL but could not be reproduced. On second launch attempt set for 0920 CST the problem repeated itself & was scrubbed til 12th.

7 Apr. U.H.

20,71

T/M	Run	Belt Revs	Time	FPS	MPH	H.R.	O ₂	R ₂
Elev	1	10	26.55				19.23	.64
TW			1.81				21.02	.66
45.0			.13				22.15	.70
30.4			↓ .15				22.62	.71
14.6			25.95				22.85	.72
~1.7			↓ .72				25.07	.73
			↓ .72				22.96	.73
			down				24.86	.74
			2					

Q 2 10 60.82
14.6 .83

TW
≈ 2.5 mph

16 May 18 Ambulatory BP working group

The individuals listed on the pg. attended meeting held at 1AH Host Hotel. BDM agreed to pay costs of transportation, transcription & publication of proceedings. Started at 0700 and had a good survey of users and their experience.

Weber

164 records

52 Dynamap

Now 3-4 records/wk.

P II + P III

1979 → Apple II → Disk → Lge. Computer

Probs. P II - tape

P III - Battery
Memory

Pt. probs.

EKG electrodes off
Sleeplessness
Arm size, etc.

Edit - uses rate of change limits vs. nominal, 2 hr. means, epochs, plots, histos. & many others.

Greatest difficulty in getting any information on unit or any assistance

Gifford

P II + P III

2 1/2 yrs. exp.

125 pts. c̄ 200 attempted recordings 25 repeats 25 normals

Holter 660 → 1979

P III

P II probs.

Cables

Transducers

Batteries (require up to 3 days charge, no indic. of failure, etc)

P III probs.

Loss of all memory ex. 3-4 lines in spite of confirming initial storage operation.

Refusal to transfer

Loss of portion c̄ old memory still present.

Operational probs

Obese & flaccid arms

Electrodes

Noise inducing activities

Service probs. warranty

Assessment

Std. validation

Comparison of intra arterial.

Kennedy

ABPWG cont'd, user experience
 250 P II records
 125 P III "

Problems -

Transducers
 Obesity

Techniques -

7 1/2 min. samples thru day & 15-30 min at night
 Means & S.D. of work, rest & sleep periods & 24 hr.
 Currently working on number of cycles above 140/90
 per Mallion.

Compares to auscultatory
 dropped pressure XHR

Harshfield

NB read note from Dr. at VA hosp. who was
 very critical of mfg. 138 pts. & continuing problems -
 cables
 service
 cuff blowing up & deflation
 inaccurate readings
 not recording on tape

Columbia 1978-81 P II & P III (51 & 12 lost)
 210 records 64 & data

Batteries

memories; "lock up" probe

Validation - std. technique

5 readings pre & post use

categories -

Clinic

Work

Home

Sleep

24 hour mean & time weighting

ABPWG

Steps

P II - needs EKG & BP

cables maj. prob.

checked technicians against machine, each other

P III one year -

long down time

Frolick

Needs equipment but bitter over implementation) P-11

Cables

Service problems

Did intra-ast. comparison $r = .92$

Few normals

Did Borderline

H.T.

Normals

He discussed a tent. publication in Daks, ed. of Am. Jour. Cardiol who promised to pub.

Also was at meeting where category of instrument was decided by Am. Coll. Phys.

Exper. level A - no pt. chgs. allowed

" " B

" "

"

- placed here

Clinical

It was unanimously agreed that a constructive report should be sent to DMA which listed the major defects including

Technical, cables, memory, etc.

Service

Marketing, honesty

Design

P III → computer coupler

RS 232

method of chg. memory, etc.

12 mos. working guarantee

"Package insert" showing

Clinical J.W. & I to write ^{draft of} this & circulate by end of week to other members of group -

It was the opinion that the instrument had the potential to become a valuable tool but is not now ready for routine sales & use.

16 May

ABPWG contd.

Publication for Am. Jour. Cardiology

Somewhat vague - ~~no~~ lack of willingness to commit on its role, accuracy, etc.

With exception of Gifford clinical indications are Clinical Investlg.

Orthostatic Hypotens. Chest pain, etc.

Drug Rx

Boldelines

Not ready for clinical use

Avoid abuses, routine use etc.

N.B. many features of use couldn't be agreed upon e.g. minimum record qual. while most used means + S.D. of time epochs.

It was further agreed to pool std. data

J.W. + S -

H. K. 90 ♂ W

Weber 10 ♂ W

T+W 90 ♀ ♂ W

Frohl 20 ♂ W

Gift 25 ♂ W

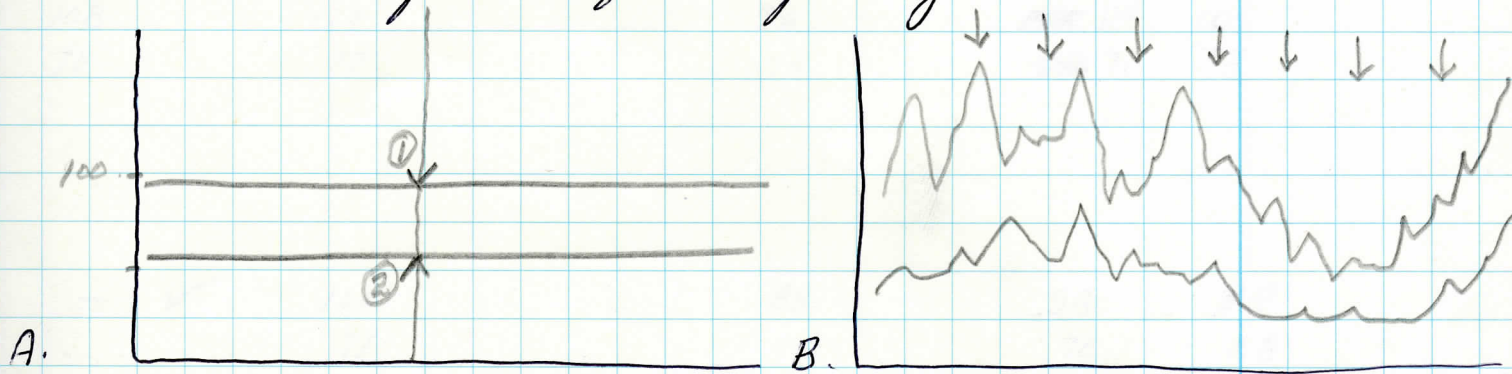
Sheps 0

Pickering 42 ♂ W

Need sex, age, ht., wt., clin data, hx. prev. B.P. or casual press.

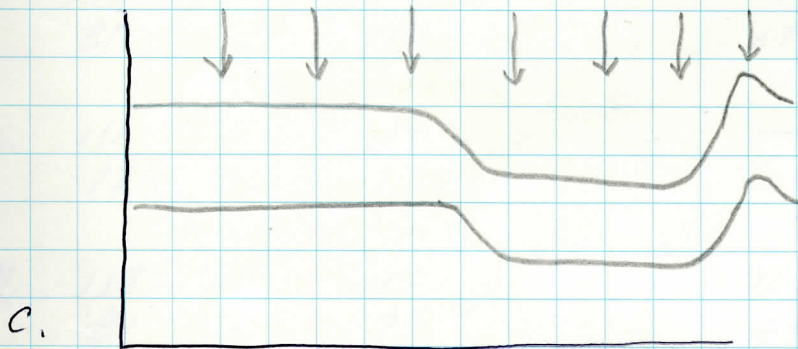
16 May Comment

It is obvious that the fundamental nature of sampling of a signal is not appreciated - Signal theory has been well worked out & should be applicable here. Practical question is how frequently should we sample. A moment's consideration shows this is a function of the signal eg.



In the case of a 'fresh' quadriplegic as in A, a single sample will suffice conversely a number of samples may be required in an active male as in B. The question is how many and where.

In its simplest form as in A the pressure consists of a steady (D.C.) component on which a regular pulsating (ripple) wave is superimposed. In addition there are more or less regular patterns superimposed the most fundamental of which is awake - sleep. N.B. The max and min of the variations are sampled. ① & ② A



This 2° change is further complicated by short term changes such as in B, where the sampling process becomes a probability function.

Normals, Pickering

Subj-	Work	Pre Sleep	Sleep	24 Hr Mn Tot	Ofc.	✓ = adequate equiv ✗ = inadequate
<u>R. Rodriguez</u>	- ✓	118	110	117	127	
	-	79	62	76	89	
<u>L. Rerisi</u>	- ✓	107	106	107	122	
	-	72	61	67	74	
<u>R. Benno</u>	108	120	96	114 114	105	
	70	77	56	72 72	73	
Brady, C.						
<u>Kalter, JM</u>	- ✓	100	88	98	85	
<u>♀</u>		71	59	70	66	
<u>Perry, J</u>	- ✓	113	94	111	110	
		83	71	82	70	
<u>Tucker, L</u>	121	110	96	112	111	
	84	71	59	79	65	
<u>Beckley, S</u>	120	110	89	111	104	
<u>♀</u>	84	83	63	76	75	
<u>Haas, B</u>	130	122	107	122	108	
	81	78	67	76	72	
<u>Rosenfeld, S.</u>	116	113	-	115	100	✗
	77	77	-	77	72	
<u>Perrone, M.</u>	117	115	104	114	107	
	81	79	68	77	77	
<u>Dulmoritz, E</u>	105	101	91	99	99	
<u>♀</u>	87	78	65	76	70	
<u>F. Patrick, R.</u>	112	102	97	103	107	
	85	75	71	77 77	77	
<u>H'lw, S.</u>	112	109	97	110	104	
TOTAL	84	76	68	78	75	
♂ 49						
♀ 34						

Normals, Pickering contd.

18 May	Work	Pre sleep	Sleep	O.Fc.	Total	
<u>Gorree, F.</u>	128 81	115 86	115 80	115 88	118 81	*
<u>Fiske, A.</u>	— ✓	124 86	119 83	126 92	123 82	*
<u>H'Field, G.</u>	139 99	127 86	104 69	130 83	124 85	
Davis, K. ♀	102 72	98 74	— —	103 76	101 74	
Solonsky, J.	140 86	137 82	— —	123 79	140 85	*
Seahill, R. ♀	96 77	91 70	— —	93 67	94 75	
Carrol, B.	142 92	121 85	— —	119 91	123 85	
Carrol, M. ♀	— —	107 76	— —	109 77	107 76	
Pickering, T.	118 79	111 79	— —	111 77	115 79	
Kaplan, P.	— —	124 88	— —	117 87	126 89	
<u>Lewis, D.</u> ♀	120 73	119 75	110 64	124 91	118 79	
Rue ♀	— —	94 68	— —	103 68	95 73	
Spence, D.	— —	103 73	— —	111 79	104 74	
Diresta, G.	98 62	115 62	— —	92 69	114 62	TOTAL ♂ 83 ♀ 1

18 May Normals, Pickering Contd.

Name	Work	Presleep	Sleep	Ofc.	Total
Levine, M.	125 70	120 72	- -	105 67	122 72
<u>Eisler, E.</u>	131 91	120 82	106 70	128 89	125 77
Wynett, S.	- ✓ -	125 94	102 83	116 89	123 90
<u>Keinert, H.</u> ♀	111 78	112 80	109 64	99 69	111 78
<u>Blank, S.</u>	107 88	114 86	105 65	113 80	110 84
Dickinson, J.	- -	135 82	- -	120 96	135 82

TOTAL

♂ 2

♀ 1

Cumul. Tot

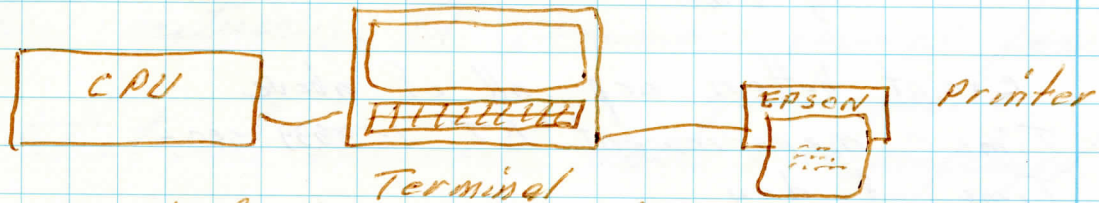
♂ ~~10~~ 14♀ ~~4~~ 5

Mon

Kennedy Normals
 2/hr during sl 4/hr awake 20-21
 C Xray, Pk EKG CBC SMA 12 Creat P. L. grid
 Urinalysis
 Casual B.P., Normal B.P. - All Working -

Notes on D.M. trip: discussed opportunity to monitor (record) 16-24 pts. X4 ABP for Kyeeth explaining arrangement planned and need to lease 3 PHL's and 1979 plus back up c 1980 via phone. Bruce flatly refused to lease them to me attempting instead to shift the business to one of the monitoring socs. Reached Deitch at home and convey info to him.

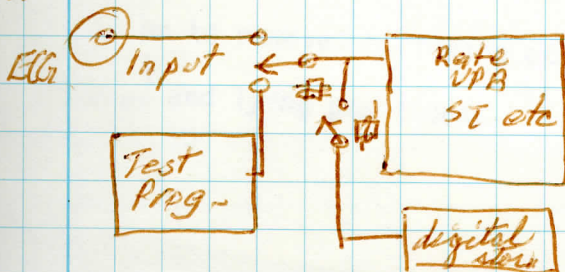
Reviewed gastric pH monitor which will have a posn. indicator. It has a low sample rate above pH 4 and increases below that. Storage is digital and replay will be printer/plotter. Reviewed 'Eldestad' computer which has a



series of stock formats including pt. info., stress test HR BP and ST level and a series of coded findings, eg. heart block, VPB, etc. all manually entered on the formats).

Discussion c Ray Cherry on new multichannel recorder and encouraged him to look at new recording media eg. laser scanning but he respond that their expertise is in mag. tape and will not change that.

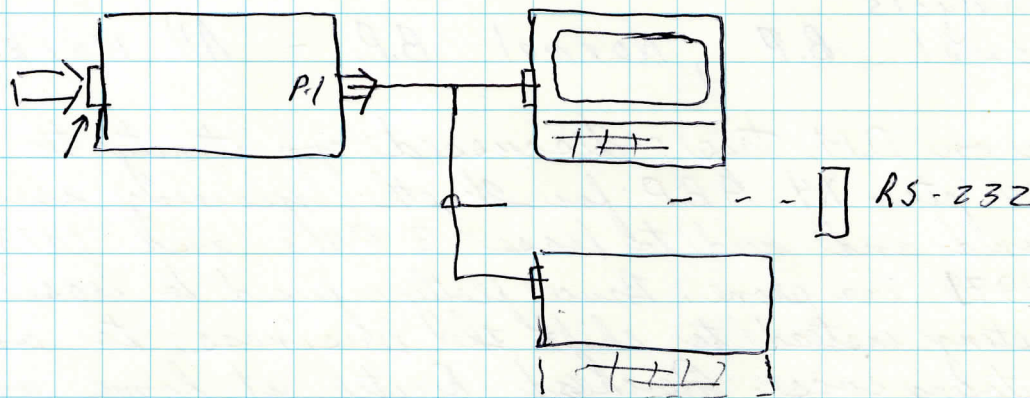
Visited H.K. c Bruce and rec'd copy of his normals plus briefing on what he is doing. I'das a number of MSS including rpt. on normals. He encouraged BDM to enter on line EKG analyzers. I encouraged Bruce to 1) keep an eye on developments 2) start low cost development which would be used for screening c folled up c Holter. Key features include an ongoing intermittent test program which would test analysis ckt. and record results and which would also record signal eg digitized ECG. Analyzer would be relatively simple and concentrate on VPB's serious arrhythmia, ST level, etc.



Dig. Rec.

Initialize:Adam 3 Televideo (600)
Hazeltine 1500 or Silent 700

Intermittent



Reset period

R (R)

Cmd- 1-5 Analog inputs, 256 X 5

Count f; count neg edges Σ 24 bit totalelect. start measure of time, analog level
log time

event button scp all of above

Time - measurement ΔT 1-9999 sec-

Time of day

3 power lines 2. P- (R)

Ready -

(Initialize) analog line # then dumps level on any Key

G(k)- storing

L(list) (R) Print

Time A-1

2

3

1

Display 20 lines

B(oud)rate) 1-6

3 Sep - Normals

Sep. analysis - $\overline{HR}$, $\overline{BP}$, S.D. Work, Sleep, & 24 hrs

3

Methodology

Both PII + PIII recorder and various computer/ software configurations were used by the investigators. The goal to record, store, edit and manipulate the data - [? comment on editing, ?] & other criteria?]. A common format for ^{agreed upon &} statistical treatment ~~was~~ was employed.

A typical ^{PII} installation is shown in Figure 1. The transducer is placed over the brachial a. located by palpation and covered by the separate, conventional arm cuff. A single EKG lead (manubrium-apex) completes the installation.

~~Calibration and verification are essential to proper use of any automated recording system.~~ Calibration features in this BPR include attachment for a Hg manometer, a manual leak valve and a ^{calibrate} switched mode such that after automatic inflation the pressure release is manually controlled. A stethoscope is placed in the antecubital fossa of the cuffed arm in the usual manner and blood pressure simultaneously determined by the BPR and the usual manual techniques. Validation is always performed at the initial attachment of the recorder to the patient and prior to removal by taking at least three simultaneous readings in standing, sitting, and lying positions.

27 Feb UTMB - Problems

293 - On on a knowledgeable med. stud. the BPR awakened him to sharp arm press. and as he was reaching for stop button, cuff ruptured.

Machine was subsequently placed on pt. to reasonable record. Today will not record on subject to prev. good records.

1979 - has broken plastic support on printer - none available

Paper

Send cc. of BPR operation

n=200 175 ♂ 25 ♀ almost wh.

ranges -

means - ^{SD} 24, work, sleep

casual B.P.

J.W. - Introd-

WT - 24 hr normal Ex & comments

Discussion of BP Data

15 May J. W. , Gil (765-1561)

Need to Xmit. existing data to IBM

- A. 1) key punch
2) TRS 80 slow

B. transmit + store^{new} data to IBM

C. Clinical
Means, 24 hr. plots

Initial approach - I/F PIII $\rightarrow$ HP 9845 & use 9845 for

- cassette storage
- display (print)
- edit
- talks to 9845
45 talks to Cyborg
- doing window (epoch) statistics on 25/45
- ? " improved plots
- ?

Discussed current status of data handling in ABP project.

Need - 1) reliable replacement for TRS-80

2) method of handling large amounts of data collected

We discussed several possibilities including:

Telephone modem / P-III to large computer (Cyborg) at Bape
Data dump to HP 9845/25 in lab. which would do
record analysis and send to Baylor for archival storage
and correlation / analysis.

Tentative approach is to use '79 to make a record
and then take PIII to pharmacology to store on
9845 cassette, do epoch statistics, and then use
9845 to do final storage / analysis -

N.B. too messy.

1. Discussion c Gil - etc
2. Confirm of performance
3. Acquisition of Hdwe -
 • Generation of S/W.

Ron Smith H.P.

Functions -

Dump/edit P.III

List

Plot BP & HR

Epoch statistics

85 Mach & mem - \$2.5

Inter face .4

P/Plot 1.27

.2

4.37

Δ time - 2 sec.

P.III

Data -

5 - 8 bit words, 2×8

0 - low

1 - Hi

HR

8

SBP

8

DBP

8

Signal - Data Ready -

Normal LO - Hi for 1 μsec
(Data is ready)

Command 1. Reset Line -

Reset

Read

Lines

Normally

Hi

Lo

(can be released
before next funct)

Hi

2. Data Send -

Lo; must

released c in 4 μs
after DR or # of lines will
repeat

Lo; must be
released c in 4 μs after
or data will dump -

Calls to H.P.

Local - H.P. Joel Weiner 776-6480 is sending GP10 man-
Martin Richardson 85 eng-

85 - GP10 - IF -
85 - 1995

PN - 82940-9-0001

Corvallis - Finney - 503 757 2000 no use -

Computique 714-549-7373

has in stock - GP10

GP10 - 439 7370-

85 - 1995

Nothing on GP10 at computique per Dave Sq.

5 Mar - Bob S - 85

Load from P-117, Man - Tape

Save

Plot

Process

Select Epoch

Revise

Y

Cont

Print

Disp
Print

Entire $\bar{x}, \sigma$, Max, min
Epoch

auto loop

Cont + Print

Sys - is value Sys status = flag

8 Feb. '82 Conversation $\bar{c}$ H.D. Miller - (Hontley) - 713-923-9171 #
 Has transducer 3-F (1.00 mm) available PR-249 1375.
 #1100. PC-340 4-F (1.333 " - .054") in stock - Will fit { #17 - .058 needle
 16 - .065 " }

Added to P.O. - H_2O pattern approved by H.D.M. - Expedite $\bar{c}$ Kurt Geist

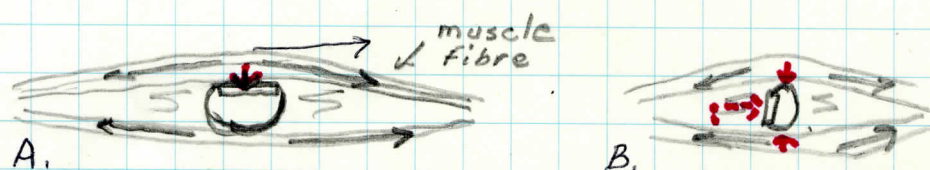
9 Feb. Miller called $\bar{c}$ name of Patrick Mc Dermott in Halifax Nova Scotia
 as a person who has used xducers in leg
 compartment syndrome studies.
 Tried to reach him - Confirmed mtg. at UTMB $\bar{c}$ Wallace, Anderson (physiol),
 and radiol

10 Feb. Peter Mc Dermott, (AGP) Children's Hospital, Halifax Nova Scotia
 902-424-6111

Discussion - Abstract in Orthopedic Transactions Dec. '81
 and accepted in Jour. of Sports Med., April 1982 STIC catheter (over)

He is obviously attempting to devise a 'new method' and was somewhat secretive. Felt that under dynamic conditions the pressure was not correctly transmitted directly to the transducer element for the pressures differed when the catheter was rotated. They use a fluid coupling of some sort but he says it will be a year before the "new system" is available. *

Comment:



It seems reasonable that he would get differing pressures under the circumstance as shown above with the lateral component of force in the fibre directly acting on the element as in A. In B the fluid pressure (dotted line) will be a function of the force and other factors. Millar also feels this is correct and since I am interested in static fluid pressure situation B should be adequate. This again raises the question of what is being measured and I feel we should make direct measurement in my leg and then do comparisons in an animal & with catheters, etc.

* McDermott also feels that the fascial compartments are separate pressure units as I do. He recommended using the 3F catheter to measure V.P. in the compartments

11 Feb. '82

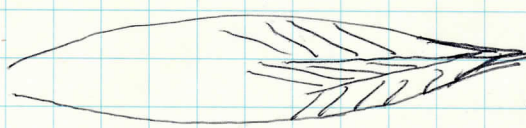
Mtg. & Wallace,

radiology + orthopedics + Anderson - dept. physiology felt that C.T. scans should be done at every level, that venography of the deep systems was very difficult and that he would be willing to do the work on Tues. or SAT. Anderson felt that pressures should be obtained of the legs but felt that internal V.P. should be measured are difficult. He saw the new G.E. C.T. which has a very large opening, est. 36", and 15° tilt on the recording head. The room is adequate for the other gear.

has extensively studied the anatomy of the lower leg and does compartment pressure meas. & the Wick technique. He showed cross sections from an excised leg and pointed out that the lateral soleus is probably best and that medial

11 Feb. UTMB mtg. cont'd.

thigh were best approaches - The soleus has numerous septa in the lower half & pennate muscle & sinuses in upper half.



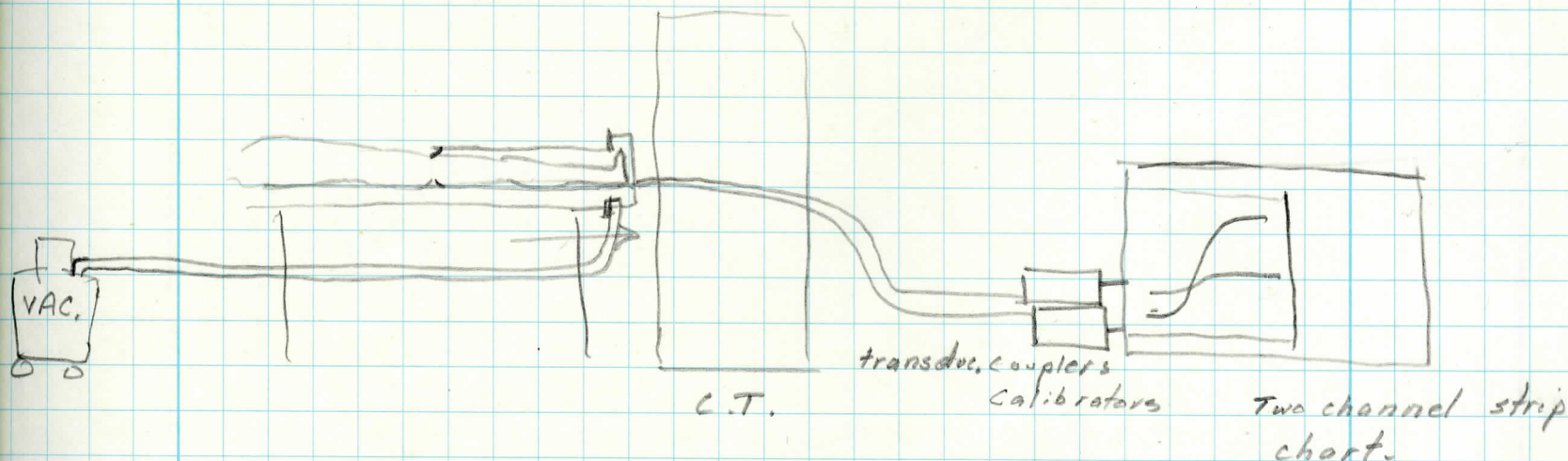
This means that large lateral forces are developed which if present around the sinuses will develop very high pump pressures.

At this time the experiment should be done as follows -

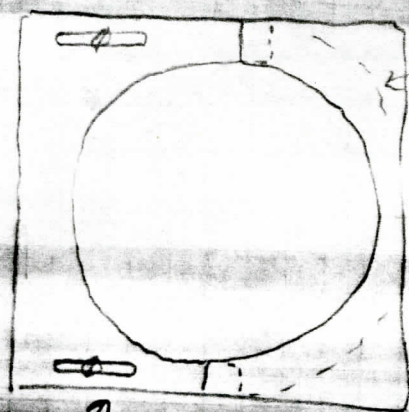
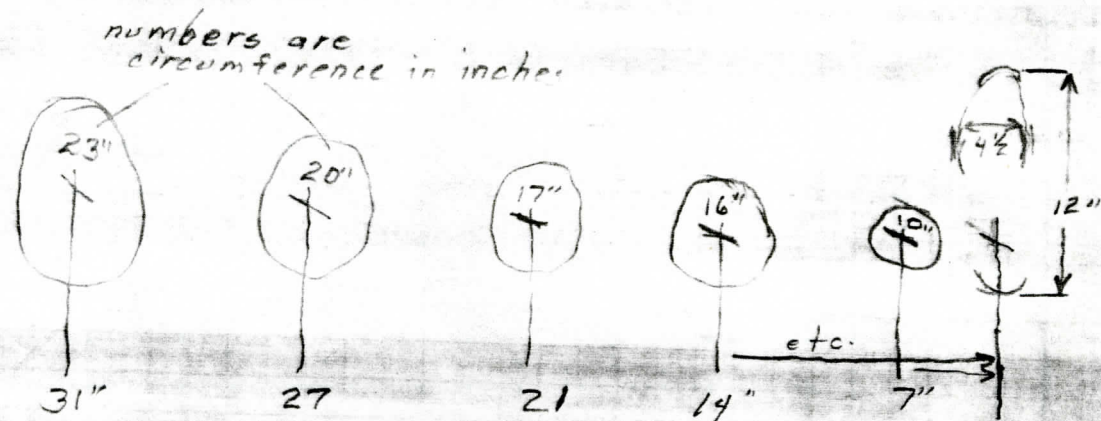
1. Initial C.T. section of leg
2. Placement of trochar in soleus & transducer at maximum insertion depth
 - a. venous pressure in superficial vein (foot or same level?)
 - b. meas. in horizontal, vertical, LBNP* and with foot pressure
3. Pull back at 1 cm. increments and repeat above meas.
4. Do same sequence in medial thigh

* - 25, ~~75~~, 50, 100, 150 mm Hg.

Physical arrangement



must accomodate leg dimensions as shown -

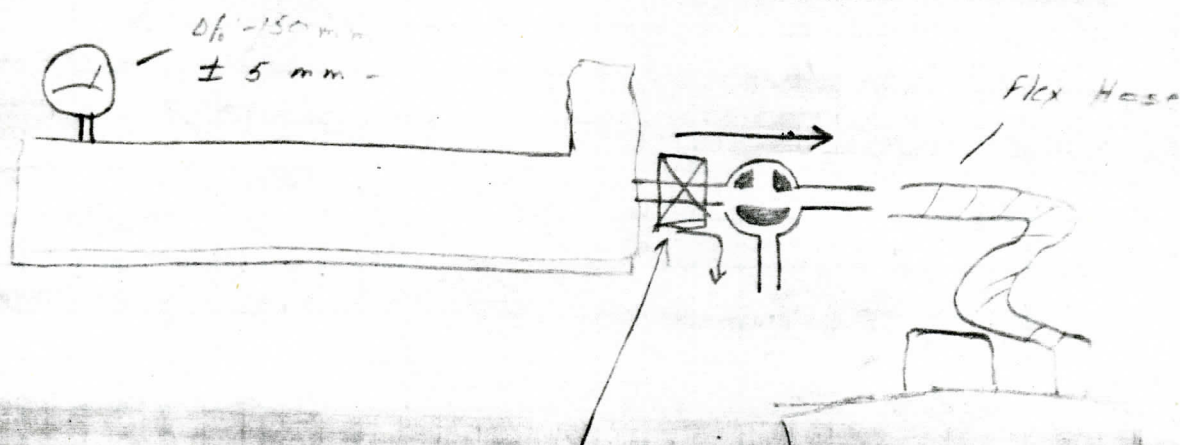


circular or square sect.
acceptable -

velcro strap

An overlapping shutter section can be used to support an air tight fabric seal - A 3 x 4" port should be located of left (toward foot) side from 12 to 16" & centered on midline. A similar port should be made on the medial side (right side) from 24 to 25". These must seal against - 150 mm Hg air pressure inside the container which as a whole must withstand this pressure level.

Plumbing for neg. press. container

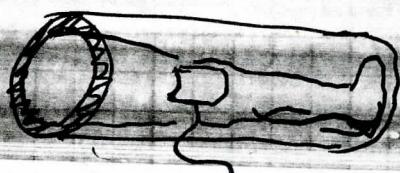


Pressure
Regulator
- 5 1/2 - 150 mm Hg.
need not be
calibrated

Vacuum
Cleaner
Sufficient
to support
-150 mm Hg
at leakage

16 Feb. 82

W/O to Bill Huber. Discussed using a large, 13" dia. plastic tube.



I will try to find
press. reg., indicator
? Hg Manometer?, etc.

Whitmore: suggests using O₂ reg. by 'reversing' & using pos. press. on sense line as signal - passed to Huber who feels we should use 11" dia. tube & 1/2" wall for press. reasons.

27 Feb

LBNP

Radiol - Luis Moretti -

765-2498

Tent. Sched.

" - Chas. Fagan

-2495

Tues

23rd?

Orthop. - Geo. Cierny

2565

J.W. depts. 26 Mar

10 Mar

Summary - Huber has completed design for Leg Neg Press assay and it is in work & est. compl. in 3 wks.
 C.F. in flt. med. will buy the transducer (1 mm. 3F) which is being handled by J. Day.

Planned protocol and arrangement follow:

1. Insert transducer in muscle and confirm location by CAT and progressively pull back known increments confirming location by CAT.
2. At each location the following maneuvers will be made;
 - A. Supine pressure measurements from I.M. xducer.
 this will be considered baseline (press. vol.)
 - B. Standing quietly until equilibrium is reached
 - C. Supine (possible leg elev.) until supine base line is reached (est. 15 min)
 - D. LNP at -10, -20, -50, -75 mm Hg. with equil. estab. at each point.

Questions:

a) Should we have a leg venous press. N.B. it was agreed that catheterizing a deep vein would be too difficult.

b) enhance the veins & contrast media to allow CAT registration

c)

c) get

6 Mar DSO Proposals for STS-

Oman- Pre-post Flight Sled Tests S-11
 Sp Lab & D- R+0.1, 2, 3, 7 - 1.5 hrs/crewman + 3hrs tng.
 P.I. - Lichtenberg

1. Perception
Parker
2. Ocular Reflex
Lichtenberg
Anderson torsion
Oman - eye dev.
3. Spinal Reflexes
Reschke
4. Manual Control
Arrot
Young

Homick- Parker proposes parallel swing - 20 mins/test
 Linear motion

A.L. Benson proposed use of common

Crewmen may have to be wheeled ("carried") out

Need a plan -
 Homick -

Lackner
 raises
 question of
 scope of
 DSO, DTO
 Soffen, Johnson
 want to force
 issue -

Space Adaptation Branch - Johnson

Post. equil. stand
 Biofeedback Lab
 Bioengineer - at Cowings
 Biofeedback
 Pharmacology
 Autogenic tng-
 S-10

Accel. PKg -
 Ex. Pot. Midbrain Z+ 8th nr -
 Pallor Monitor
 Gastogram
 Heidelberg capsule
 Constriction of visual field
 Hand held (Cargen Research)
 Visual Motor Reax

Pharmacology #1
 Autogenic #2
 Devices #3

6 Mar.

5 AS Branch -

Identify StimuliIdentify SxPerformance EffectsCountermeasures / Restriction of Visual ChangeDrug Absorption

Vit. Riboflavin

Antibiotic - Amoxicillin

Drug Testing

Motochlorpromide

Buccal Scopolamine

Tricyclic Antidepressants

G-suit - (if visual field is constricted)

Biofeedback Trng -

Adaptation Trng - chair

ResearchReflex, tendon
otherOman

head movement

What is stimulus - i.e. inputs - meas. $\in$ ARU3 angular & 3 linear accelerometer $\rightarrow$ SRI recorder

Sx. Monitor

Countermeasures

Restrict head motion

Describes MIT units

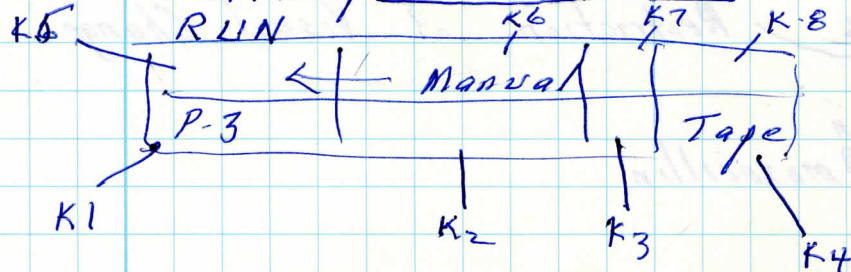
12 Apr.

HP 85 -

Pwr - Rear cursor on Insert Cart.

CAT - END LINE (Key)

List appear - examine by ROLL

LOAD sp "33083" EL cursor appears

Cat Appears

6 Character
Data FileL1234A, DATAL1234A EL

Lists Title & Loads - Flashing Light & Video

Save	Plot Raw		
Plot	Process	END PCH	Revise

(Process -)
Disp. or Plot
D EL

To Print

Any thing on
screenCalculating -
CONT

To stop hit PAUSE (key)
Continue CONT

hit COPY upper case

(Revise)

To change data or Flags

NB

Don't Do Consecutive plots

Bad statement

RUN

NB

When removing Flag bring data within limits

NB

Data must always be processed

Edit

Criteria

Sys < 70 250 >

Sys-Dia < 10 Sys+Dias +

Dia > Sys or MS < 40 or = Sys

Rate < 30 or > 215

HP 85 contd-

Load Plll

?

Pt. Name -

I.D. Number

Med

Doctor

Start time

L 234

02

0

13 Aug - SAVE

ENTER UNIQUE 6 CHAR FILE NAME (Quotes not reqd)

Th 138

(May be numerals & Ltrs)

Loads into tape - blinking tape

Process

Use Quotes τ file name.

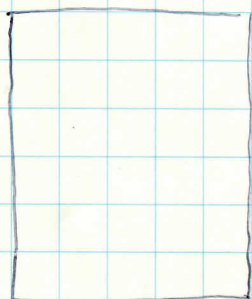
Type or Displ. CONTINUE

Don't plot raw after plotting smooth

Must use exact numbers (times) for epoch

13 Aug '83 EPROM Storage (from P-87 S-7 N.B.K.)

Green box - Loader (P111 to chip)



Ma. M.

Ex. Order 10096 - '49.