

Up The (radio) Decade!

V. TRIMSE
UCI + LCOGT

Whitford - 1960's

ground only

Greenstein - 1970's
(oops - cobs)

Field - 1980's

Santa Fe RMS
Mar 2011

Bahcall - 1990's

Too early for WMAP

McNee-Taylor - 2000's

Too late for WMAP

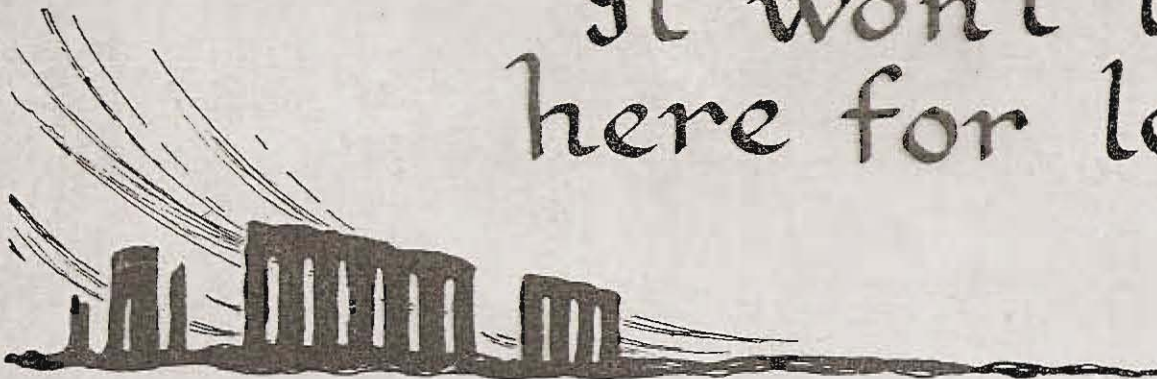
Blandford - 2010's

© BRILLIANT ENTERPRISES 1977.

POT-SHOTS NO. 1181

Don't take
the present moment
too seriously —

It won't be
here for long.



Ashleigh
Brilliant

TABLE 6: SCORECARD

ALL λ

REPORT	Number of Identifiable Items Requested	Number in Operation ≤ 15 yr after report with mostly federal funding	Number in operation ≤ 15 yr after report with mostly other funding (state, private, foreign)	Number eventually built with mostly federal funding	Number eventually built with mostly other funding	Never/very unlikely
Whitford	13	6	0	0	1	6
Greenstein	21	5 (+1 similar)	2	4	1	8
Field	21	3 (+2 similar)	2	3	2	9
Bahcall	29	11	6	5	0	7
McKee-Taylor	23	8	1	5	3	6
TOTAL	106	33 (+ 3 similar)	11	17	7	36

PANEL ON ASTRONOMICAL FACILITIES

- A. E. Whitford, Chairman, Lick Observatory, University of California
R. N. Bracewell, Radio Astronomy Institute—Radioscience Laboratory, Stanford University
—Frank D. Drake, Department of Astronomy, Cornell University
Frederick T. Haddock, Jr., Radio Astronomy Observatory, University of Michigan
—William Liller, Department of Astronomy, Harvard University
W. W. Morgan, Yerkes Observatory, University of Chicago
Bruce H. Rule, California Institute of Technology
—Allan R. Sandage, Mt. Wilson and Palomar Observatories, California Institute of Technology,
Carnegie Institution of Washington

Whitford - publ. 1964

ITEM	\$M	RESULT
array, 3 cm 100 X 85'	40	VLA 1978 17 X 25 ^m
Owens Valley to 6-8 X 130' mm	10	OVRO + BIMA = CARMA 2007, many dishes
2 X 300' fully steerable parabs to 3 cm	16	Greenbank 300', 1962 140' 1965 Goldstone 210' 1967 mostly tracking
15 smaller, special purpose, not NRAO	30	Clark Lake 68; other U Md 69-70; Haystack 64; Hat Creek 66-68; Stanford 70; Ill 70 Iowa 67-70; FCRAO 70 Cornell 70; Harvard 71 Penn State 68-72
Design study, max. fully steerable paraboloid	1	No (Arecibo 63 + up- grades; rebuilt GBT) <i>SUGAR GROVE PLASCO (defunct 8/8/88)</i>
Better short λ radio receivers		NRAO 12m mm dish 1967

Solar radar not recommended

- JESSE L. GREENSTEIN, California Institute of Technology, *Chairman*
 \ HELMUT A. ABT, Kitt Peak National Observatory \circ
 \ JACQUES BECKERS, Sacramento Park Observatory \circ
 GEOFFREY BURBIDGE, University of California, San Diego \mathcal{R}
 \ BERNARD F. BURKE, Massachusetts Institute of Technology \mathcal{R}
 ALASTAIR G. W. CAMERON, Yeshiva University \mathcal{R}
 \ FRANK D. DRAKE, Cornell University \mathcal{R}
 \ RAY L. DUNCOMBE, U.S. Naval Observatory \mathcal{R} \circ
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 \ GEOFFREY KELLER, Ohio State University \mathcal{R} \circ
 \ ROBERT P. KRAFT, University of California, Santa Cruz \circ
 ROBERT B. LEIGHTON, California Institute of Technology \mathcal{P}^1 - \mathcal{L}
 \ DONALD C. MORTON, Princeton University Observatory \mathcal{R}
 \ ROBERT NOYES, Smithsonian Astrophysical Observatory \mathcal{S} \mathcal{R} \mathcal{P}
 CHARLES R. O'DELL, Yerkes Observatory \circ
 \ JEREMIAH P. OSTRIKER, Princeton University Observatory \mathcal{R}
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 HARLAN J. SMITH, University of Texas \circ
 LYMAN SPITZER, Princeton University Observatory \mathcal{R}

BRUCE N. GREGORY, *Executive Secretary*

Cosmologists ??

Greenstein Radio

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BERNARD F. BURKE, Massachusetts Institute of Technology
MARSHALL H. COHEN, California Institute of Technology
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JAMES W. WARWICK, University of Colorado
GART WESTERHOUT, University of Maryland

Greenstein Space

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JACK R. JOKIPIII, California Institute of Technology
DOUGLAS P. McNUTT, U.S. Naval Research Laboratory
TOBIAS OWEN, State University of New York, Stony Brook
JACK B. ZIRKER, University of Hawaii
ROBERT O. DOYLE, Harvard College Observatory, *Consultant to Panel*

Cosmologists???

Greenstein - publ. 1972

ITEM	\$M	RESULT
VLA	62	Yes - 1978
Large mm array or 10m dish	10	ALMA 2011; ARO 2000+ (NRAO, Hertz)
Large cm array	35	No (though VLA to cm) etc
Panel: also steerable cm, large mm for molecules		
Radio from space for AGNs; longer baseline interferometry		
3K radiation to be studied from balloons and rockets (WHY???)		
1974 NASA AO yielded 3 satellite CMB proposals. Merged (forcefully). COBE 1989		

GEORGE B. FIELD, Harvard-Smithsonian Center for Astrophysics, *Th*
Chairman

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the University of Colorado

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PANEL ON RADIO ASTRONOMY

Field

PATRICK THADDEUS, NASA Goddard Institute for Space Studies
and Columbia University, *Chairman*

BERNARD BURKE, Massachusetts Institute of Technology

MARSHALL COHEN, California Institute of Technology

FRANK DRAKE, Cornell University

MORTON ROBERTS, National Radio Astronomy Observatory

JOSEPH TAYLOR, Princeton University

WILLIAM J. WELCH, University of California, Berkeley

DAVID WILKINSON, Princeton University

ROBERT WILSON, Bell Laboratories

Consultant

GEORGE A. DULK, University of Colorado

Field - publ 1982

ITEM	\$M	RESULT
VLBA	60	Yes - 1992
10 ^m deployable reflector in space for FIR, mm	300	(Herschel 2009; ^{2.5m} WFIRST in 2010 report)
Space VLBI	60	No (TDRS prototype; HALCA 1997; RadioAstron Russia)
10 ^m for submm	4	CSO 1988, Hertz SMT 1994; now ARO
MIR heterodyne interferometer	3	Townes at Mt. W.

Panel: 100m steerable to 1 cm; radio spectrographs & polarimeters on Star Probe & Solar Coronal Explorer; development for 10-m submm in NEO; 5-10m mm for So. Hemisphere

Very important non-US: JCMT, IRAM...

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BLAIR SAVAGE, University of Wisconsin S
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SIDNEY WOLFF, National Optical Astronomy Observatories O

Bahcall RADIO ASTRONOMY

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Bahcall - publ. 1991

ITEM	\$M	RESULT
Extended VLA	32	(2012)
CBI	7-10	2002 + DASI, MAXIMA, Boomerang, etc
300m for Brazil	10	No
25 m space	10	No
PANEL:		
50m for mm	115	No
solar, frequency-agile ST	0.4	No
VLBI in space	200	No
FAST 20X3 ^m all-sky survey		No

There were no "large" radio programs recommended

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TODD BOROSON, National Optical Astronomy Observatories 0

~~WENDY FREEDMAN~~, Carnegie Observatories 0

DAVID C. JEWITT, University of Hawaii 0

STEVEN M. KAHN, Columbia University 5r

JAMES M. MORAN, JR., Harvard-Smithsonian Center for Astrophysics

JERRY E. NELSON, University of California Observatories 12

R. BRUCE PARTRIDGE, Haverford College 13

~~MARCIA RIEKE~~, University of Arizona 0

~~ANNEILA I. SARGENT~~, California Institute of Technology 0

ALAN TITLE, Lockheed-Martin Space Technology Center 0

SCOTT TREMAINE, Princeton University 7

MICHAEL S. TURNER, University of Chicago

PANEL ON RADIO AND
SUBMILLIMETER-WAVE ASTRONOMY

McKee - Taylor

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WILLIAM J. WELCH, University of California, Berkeley

DONALD BACKER, University of California, Berkeley, Consultant

McKee/Taylor - Published 2001

ITEM	\$M	Result
EVLA	140	2012 (now "major")
SKA start	22	probably not us; ASKAP (Australia), MeerKAT So. Afr. (Allen????)
CARMA 25 dishes	11	Yes, BIMA = 10, OVRO = 6, plus. 2007
ARISE (space radio interf)	350	No (Japan, Russia?) (explicit in 2010)
FASR (sun)	26	Not in 2010 (no?)
So. Pole Submm Tel	50	Not in 2010
LOFAR	8	(for US-Dutch) NL dedication May 2010

Blandford - publ. 2010 (bravo)

"Concerning that about which one may not speak,
one must remain silent."

Wittengenstein (1889-1951)

Facility	2001 & 2002		2003		02-08		Total C/P	
	Citations	Papers	Citations	Papers	Citations	Papers		
INTERFEROMETERS, PARTS USED SEPARATELY, AND SINGLE DISHES								
VLA (2570)	5634	380.9	2844	201.3	8478	582.2	14.6	
VLBA + dishes	809	69.9	352	35.3	1161	105.2	11.0	
Arecibo	636	56.4	333	28.3	969	84.7	11.4	
Greenbank (all)	308	25.6	201	13.2	509	38.8	13.1	
DRAO	88	14.1	143	17.0	231	31.1	7.4	
Other W. Hemisphere	81	18.5	73	9.1	154	27.6	5.6	
Aust. Tel. comp. Arr.	962	89.6	742	49.8	1704	139.4	12.2	
Parkes	1164	68.1	505	30.5	1669	98.6	16.9	
Aust. other + DSN	200	25.2	219	12.2	419	37.4	11.2	
Merlin	326	38.0	177	18.2	503	56.2	8.9	
Jodrell Bank (all)	153	14.5	64	5.1	217	19.6	11.1	
Ryle 2CMB	49	6.5	214	6.7	263	13.2	19.9	
Euro. VLBI Network	150	19.3	54	7.7	204	27.0	7.6	
Westerbork	447	37.2	194	24.1	641	61.3	10.5	
Effelsberg	355	38.7	257	23.5	612	62.2	9.8	
Puschina	36	12.3	31	12.7	67	25.0	2.7	
RATAN600	26	12.2	25	5.2	51	17.4	2.9	
Other Europe	369	75.5	190	22.0	559	97.5	5.7	
GMRT + Ooty	98	24.0	108	12.1	206	36.1	5.7	
Other Asian	81	19.5	32	4.3	113	23.8	4.8	
VLBI other	69	12.6	46	8.4	115	21.0	5.5	
HALCA	29	4.0	1	0.3	30	4.3	7.0	
Class Total	12018	1060.0	6857	547.0	18875	1609.7	11.7	
CMB AND COSMOLOGICAL STUDIES								
WMAP	-	-	2878	34.9	2878	34.9	82.5	
COBE	423	25.2	305	20.1	728	45.3	16.1	
Boomerang	610	12.4	111	5.0	721	17.4	41.4	
Maxima	570	8.3	52	3.3	622	11.6	53.8	
DASI	607	5.7	66	1.5	673	7.2	93.5	
VSA	-	-	208	8.2	208	8.2	25.5	
CBI	-	-	798	5.3	798	5.3	149.4	
Other CMB	365	17.0	703	10.3	1068	27.3	39.1	
3C, 6C, 7C, etc.	229	16.6	69	5.2	298	21.8	13.7	
Class Total	2804	85.2	5190	93.7	7994	178.9	44.7	
MILLIMETER AND SUBMILLIMETER								
NRAO 12 m	300	25.2	158	10.3	458	35.5	12.9	
Caltech SO	273	19.3	187	12.2	460	31.5	14.6	
5 Coll. RAO	308	21.3	77	13.9	385	35.2	10.9	
OVRO 2CMB	472	42.7	194	14.5	666	57.2	11.6	
BIMA	566	39.2	265	19.0	831	58.2	14.3	
SWAS (satellite)	170	14.6	19	2.0	189	16.6	11.4	
JCMT	1951	102.2	1266	75.9	3217	178.1	18.1	
IRAM 30 m	1108	73.0	477	40.2	1585	113.2	14.0	
IRAM Interf.	361	24.7	319	17.7	680	42.4	16.0	
SEST	305	35.9	125	18.9	430	54.8	7.9	
H. Hertz	65	10.1	24	5.8	89	15.9	5.6	
Nagoya 4 m	84	16.1	8	2.0	92	18.1	5.1	
Nobeyama 45 m	199	34.0	70	9.8	269	43.8	6.2	
Nobeyama Int.	72	12.9	59	11.2	131	24.1	5.4	
Antarctic submm	40	5.3	-	-	40	5.3	7.6	
Other mm /submm	342	25.4	49	3.9	391	29.3	13.3	
Class Total	6726	501.9	3296	257.3	10023	759.2	13.2	
RADIO TOTAL	21548	1647.0	15346	901.0	36894	2548	14.5	

08

09

Facility	Papers ¹	Citations ¹	C/P ¹ / <i>lyr</i>	Papers ²
<u>VLA</u> (26%)	129.1	396	3.07	262.9
<u>WMAP</u>	24.7	101	4.09	54.9
IRAM <i>Eur</i>	36.3	172	4.74	65.0
JCMT <i>U.S.</i>	26.65	123	4.62	52.8
SMA	15.1	35	2.32	37.1
BIMA	8.0	15	1.88	11.7
CSO	8.7	28	3.22	17.8
OVRO	4.45	7	1.57	8.2
FCRAO	9.0	39	4.33	14.0
APEX/ASTE	8.5	11	1.29	19.0
ATCA	23.2	47	2.03	48.0
Parkes	16.2	47	2.90	31.0
VLBA	17.2	52	3.02	39.0
Eur VLBI Network	7.1	19	2.68	19.6
GMRT	15.0	31	2.07	24.4
Arecibo	19.1	47	2.46	33.7
GBT	13.9	32	2.30	29.9
Nobeyama	11.5	19	1.65	15.2
WSRT	11.3	27	2.39	22.2
Effelsberg	9.45	12	1.27	19.0
SEST	6.0	11	1.83	9.5
ARO	5.0	6	1.20	12.1
Merlin	4.45	19	4.27	9.2
NANTEN	4.3	12	2.79	11.6
Ryle	4.25	6	1.41	5.35
<u>TOTAL RADIO</u>	1479.3	1369	2.86	1010.6

US

On-going issues

ground \$\$\$
vs
space \$\$\$\$

radio \$\$\$
vs
optical \$\$\$\$

national/public \$\$\$
vs
restricted/statal ???
foundation,
etc.

International collabs.
ESO vs NOAO (Brazil)

NASA vs ESA

NRAO vs (um)

Prioritizing
together
proportion
direction + speed
purpose

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SANTA BARBARA

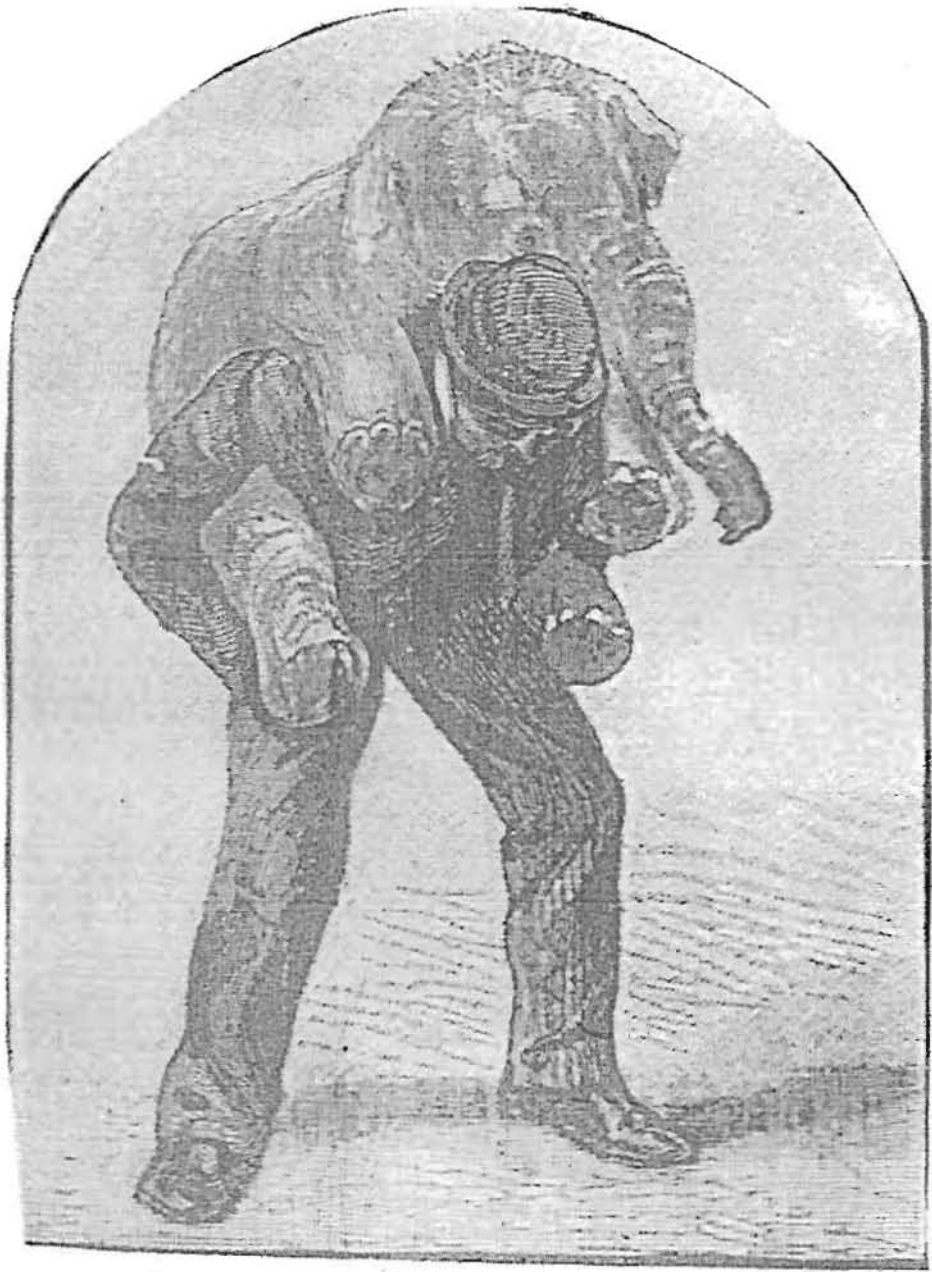
Ashleigh Brilliant

POT-SHOTS No. 3877.

THE ONLY REQUIREMENT FOR EVENTUALLY GETTING THERE

IS TO KEEP GOING IN THE RIGHT DIRECTION.



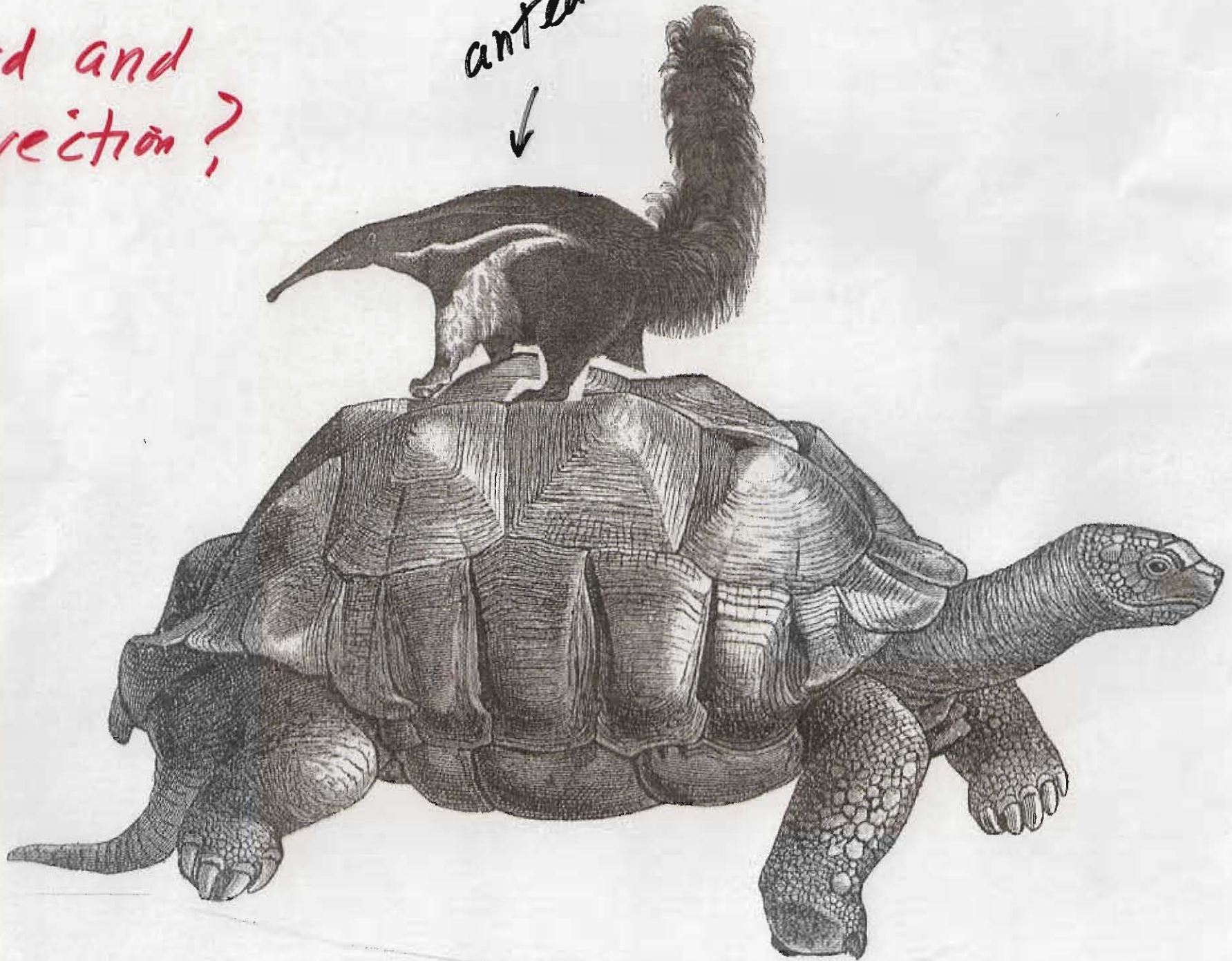


The issue of relative proportions
(Relevance of Apollo)

Proportions OK

Speed and
Direction?

anteater



Proportions, speed, direction OK

Discordant Purposes

