Cosmic Chemistry: Planetary Diversity

Are We Related? Looking for Patterns In Planetary Diversity

STUDENT DATA SHEET—PART 1

Data Table 1

Planet	Average Distance From Sun		Diameter (at equator)	
	AUs	**10^6km**	**Km**	**Earth = 1**
Mercury	0.387	57.90	4,880	.38
Venus	0.723	108.20	12,100	.95
Earth	1.000	149.60	12,760	1.00
Mars	1.524	227.90	6,790	.53
Jupiter	5.203	778.30	142,900	11.20
Saturn	9.539	1,427.00	121,500	9.45
Uranus	19.180	2,870.00	51,120	4.00
Neptune	30.060	4,497.00	49,500	3.80
Pluto	39.530	5,914.00	6,000	.50

Sources: See Note 1

Data Table 2

Planet	Average Distance From Sun		Average Temperature
	AUs	**10^6km**	**°C**
Mercury	0.387	57.90	260^
Venus	0.723	108.20	465
Earth	1.000	149.60	15
Mars	1.524	227.90	-23
Jupiter	5.203	778.30	-150
Saturn	9.539	1,427.00	-180
Uranus	19.180	2,870.00	-210
Neptune	30.060	4,497.00	-220
Pluto	39.530	5,914.00	-220

Note. ^*Mercury's "days," noon to noon, are equal to 176 Earth days, so it has a "daylight" side whose temperature averages 350 °C and a "night time" side, with an average temperature of -170 °C.*

Sources: See Note 2

Data Table 3

Planet	Average Distance From Sun		Relative Period of Rotation on Own Axis^
	AUs	**10^6km**	**(in days) Earth=1**
Mercury	0.387	57.90	58.65
Venus	0.723	108.20	243.01 ◊
Earth	1.000	149.60	1.00
Mars	1.524	227.90	1.03
Jupiter	5.203	778.30	.41
Saturn	9.539	1,427.00	.44
Uranus	19.180	2,870.00	.72 ◊
Neptune	30.060	4,497.00	.63
Pluto	39.530	5,914.00	6.38

Note. ^*Relative to the stars,* ◊ *Indicates retrograde motion*

Sources: See Note 3

Data Table 4

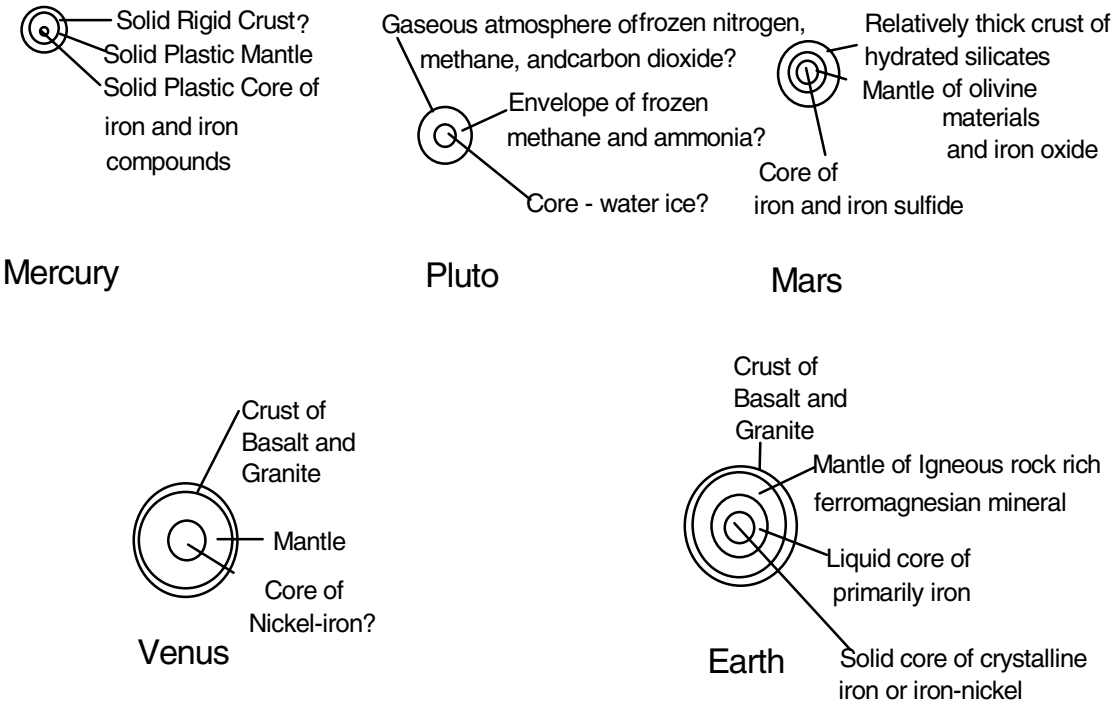
Planet	Average Distance From Sun		Relative Mass	Relative (Average) Density
	AUs	**10^6km**	**Earth=1**	**Earth=1**
Mercury	0.387	57.90	.0550	1.00
Venus	0.723	108.20	.8140^	.95
Earth	1.000	149.60	1.0000	1.00
Mars	1.524	227.90	.1080^	.71
Jupiter	5.203	778.30	317.8000^	.24
Saturn	9.539	1,427.00	95.2000^	.13
Uranus	19.180	2,870.00	14.5000^	.24
Neptune	30.060	4,497.00	17.2000^	.29
Pluto	39.530	5,914.00	.0025^	.38

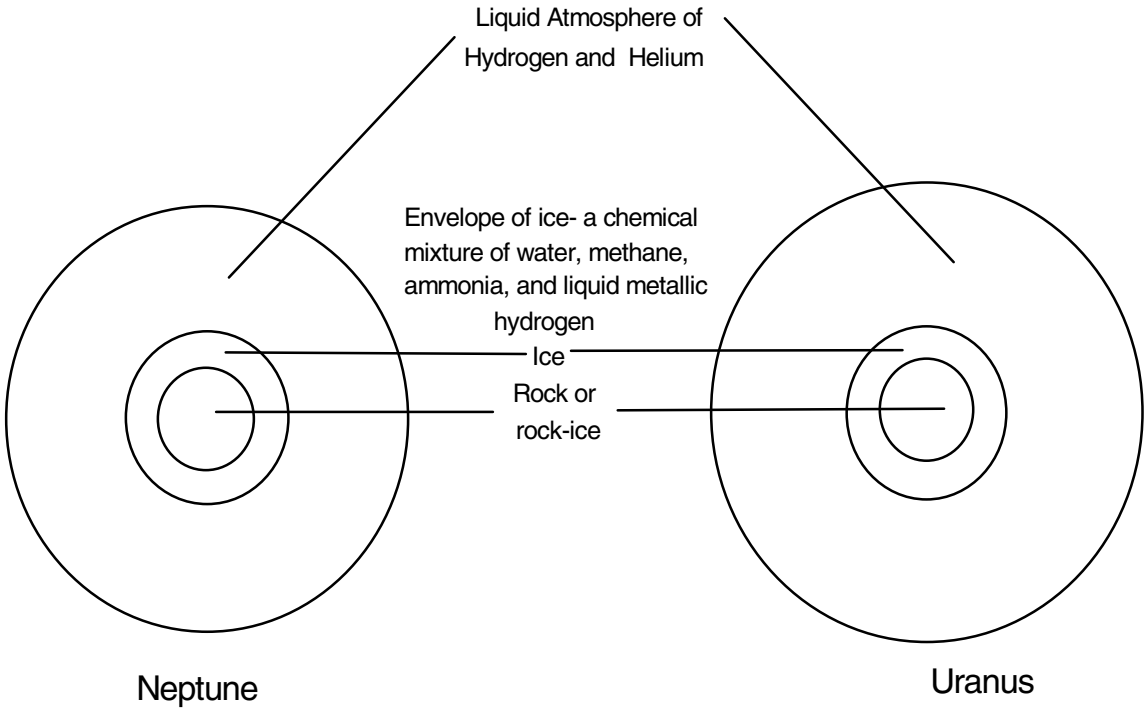
Note. ^*Rounded from Darwin Space Infrared interferometer project, May 21, 1998, NSSDC Planetary Science, which, in most cases showed at least one more significant digit in the measurement.*

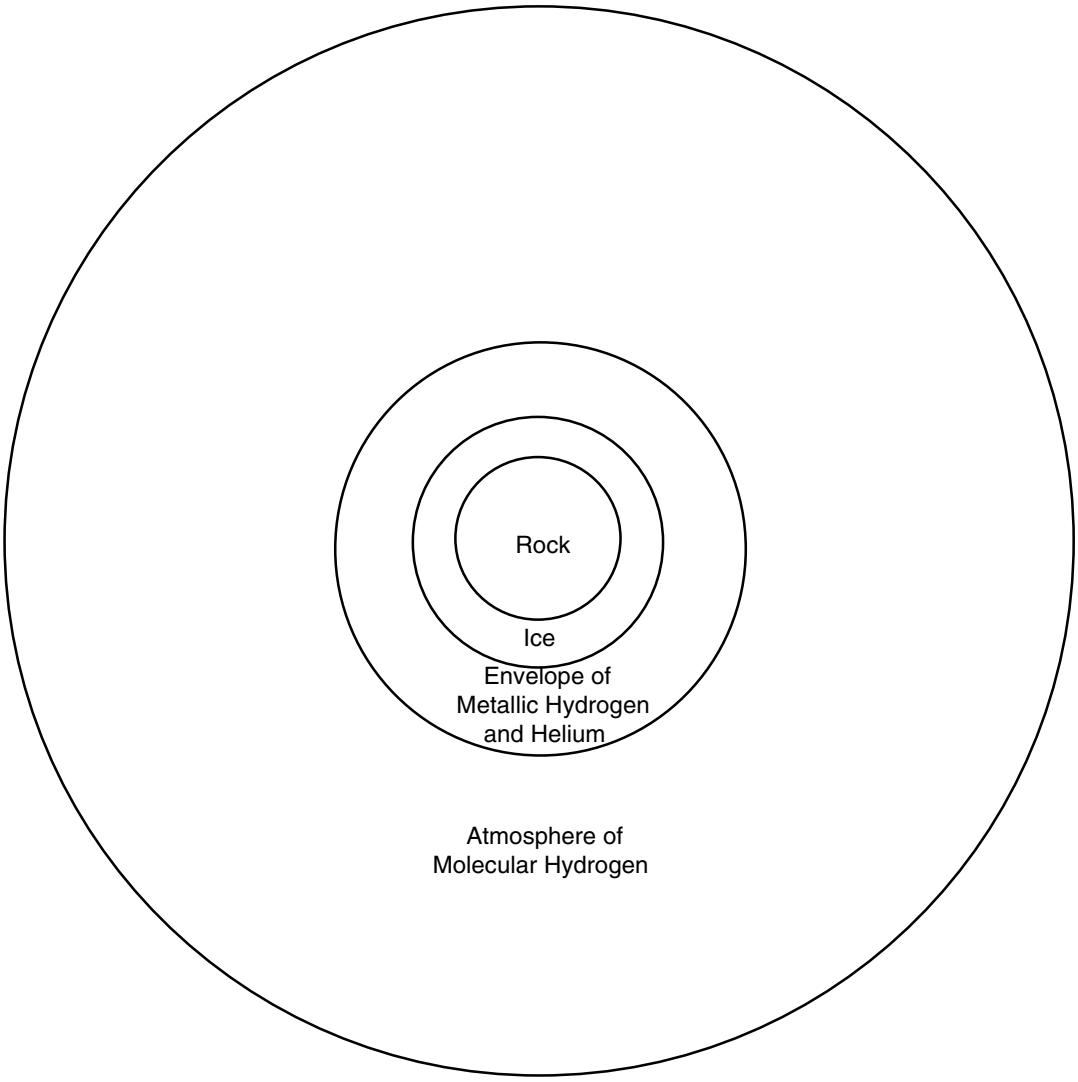
Sources: See Note 4

Below you will find diagrams of internal structures of planets. Do not read more into these diagrams than is warranted. The overall diameters of these cross-sectional diagrams are drawn to scale. Since even the constituents of some internal partitions are, in some cases, conjecture, the size of the partitions should not be considered as you look for patterns or groupings of the planets based on internal structures.

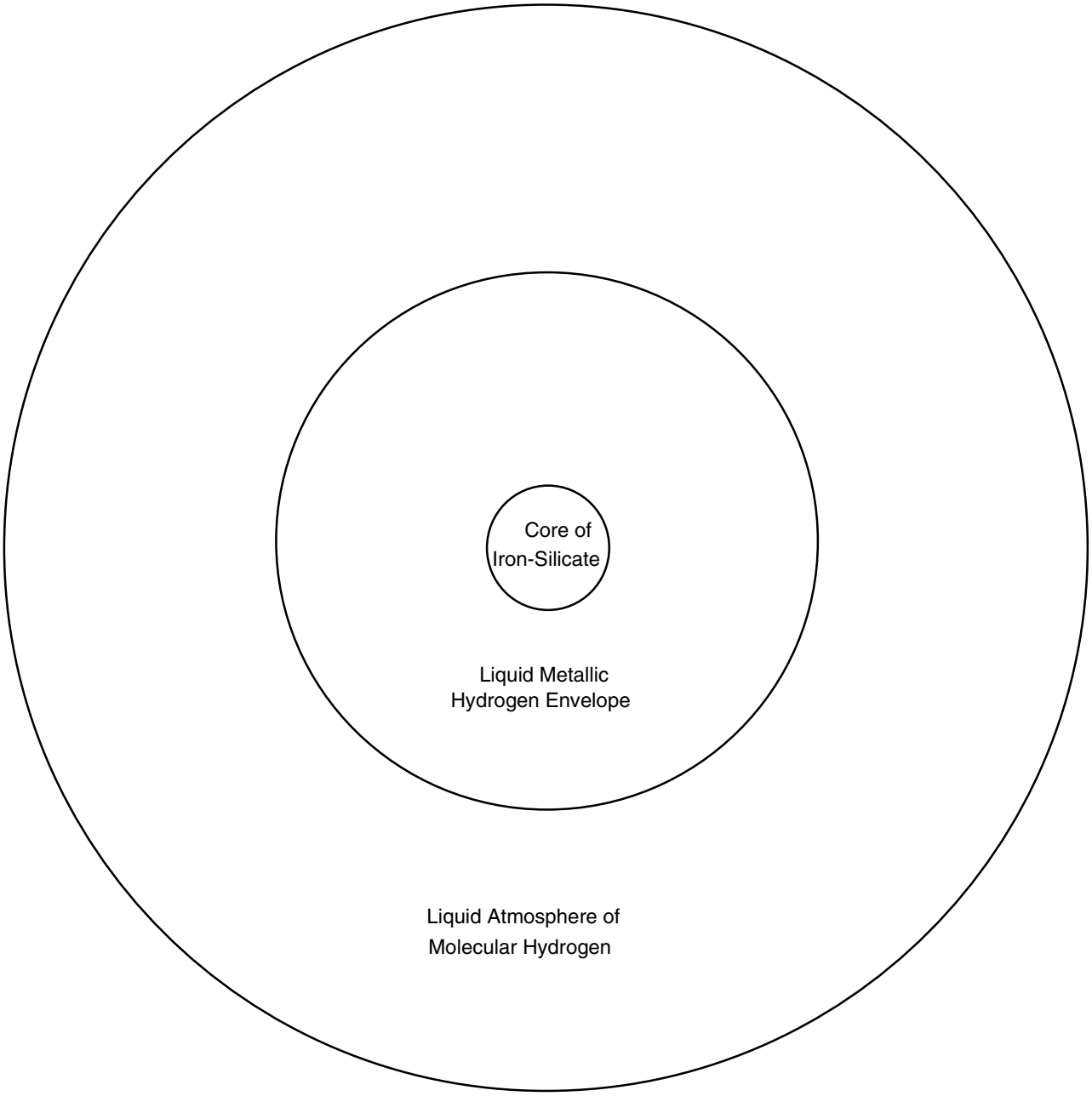
DIAGRAMS OF INTERNAL STRUCTURES OF PLANETS (1.5 cm = 12,760 km)






Rock
Ice
Envelope of
Metallic Hydrogen
and Helium
Atmosphere of
Molecular Hydrogen

Saturn


Core of
Iron-Silicate
Liquid Metallic
Hydrogen Envelope
Liquid Atmosphere of
Molecular Hydrogen

Jupiter

Data Table 5

Planet	Pressure	Atmospheric Constituents
Mercury	10^{-15} atm	He (42%), Na (42%), O_2(15%); traces (in ppm) of H_2 (10,000), K (2,000)
Venus	90 atm	CO_2 (96%), N_2 (3.5%); traces (in ppm) of H_2O (100), SO_2 (150) Ar (70), CO (40), Ne (5-7), He (5.2-12), HCl (0.4), HF (.01), Kr (0.7)
Earth	1 atm	N_2 (78 %), O_2 (21%), H_2O (1 %), Ar (.93 %); traces (in ppm) of CO_2 (330), Ne (18), He 5.2), Kr (1.1), Xe (.087), CH_4 (1.5), H_2 (.5), N_2O (.3), CO (.12), NH_3 (.01), NO_2 (.001)
Mars	.007 atm	CO_2 (95 %), N_2 (2.7 %), Ar, (1.6 %), O_2 (.13%) ; traces (in ppm) of CO (700), H_2O (300), Ne (2.5), Kr (.3), Xe (0.8), O_3 (.1)
Jupiter	1 bar at lowest observable levels	90% H_2, 10% He, .0001% H_2O, .02% CH_4,.03% NH_3, traces of C_2H_6, C_2H_4, C_2H_2, C_6H_6, CH_3C_2H, PH_3, GeH_4, and CO
Saturn	1 bar at lowest observable levels	94-97% H_2, 3% He, 0.2% CH_4, 0.03 NH_3, traces of C_6H_6, C_2H_2, and PH_3
Uranus	Unknown	83% H_2, 15% He, 2% CH_4, traces of C_2H_6, C_2H_2,
Neptune	Unknown	H_2, He, CH_4 (presumed to be similar to that of Uranus)
Pluto	Unknown	CH_4? N_2 ? CO_2 ?

Sources: See Note 5

Data Table 6

Planet	Particulate Compostion	Altitude	Areal Distribution	Optical Depth τ^
Mercury	none			
Venus	sulfuric acid	50-80	everywhere	≈ 25
Earth	sulfuric acid	12-30	everywhere	.003-.3#
	sulfates, silicates, seasalt,	0-12	everywhere	
	organics		(spatially variable)	
	water	0-12	50% cloud cover	5
Mars	dust	0-50	everywhere	.3-6##
	water, ice	0-50	winter polar region	≈ 1
			morning fog; isolated clouds many places	≈ .001
	CO2 ice	0-25	winter polar region	≈ 1

^*Optical depth is a measure of the degree to which particles interact with sunlight; when τ is much less than 1, very little sunlight is scattered or absorbed; when τ is large, the opposite is true*
#*Sulfuric acid values high after volcanic eruptions*
##*Maxima due to dust during global dust storms*

Sources: See Note 6

The detection instruments in space craft have provided us with much defining information regarding the atmospheres of the planets, especially Venus, Mars, Mercury, Jupiter, and Saturn, as well as some characteristics of Uranus' cloud-top atmosphere.

Data Table 7

Planet	Surface Gravity	Period of Revolution	Number of Known Moons	Rings	Inclination of Axis	Inclination of Orbit to Ecliptic
	Compared to Earth (multiply)	Earth Days (D) Earth Years (Y)			Degrees	Degrees
Mercury	0.38	87.97 D	0	None	0	7.00
Venus	0.905	224.7 D	0	None	177.3	3.39
Earth	1	365.26 D	1	None	23.5	0.00
Mars	0.377	686.98 D	2	None	25.2	1.85
Jupiter	2.53	11.86 Y	16	1	3.08	1.31
Saturn	1.14	29.46 Y	20 +	Thousands	26.7	2.49
Uranus	0.90	84.07 Y	15	11	97.9	0.77
Neptune	1.14	164.82 Y	8	5	29.6	1.77
Pluto	0.08	248.6 Y	1	None	122	17.15

Sources: See Note 7

Note 1: Sources for data in Table 1 are:
Darwin Space Infrared Interferometer Project. (May 21, 1998). NSSDC Planetary Science.
Henbest, N. (1992). The Planets: Portraits of New Worlds. New York: Nigel Viking, Penguin Group.
Kaufmann, III, W. J. (1978). Exploration of the Solar System. New York: William J.. Macmillan Publishing (
Smoluchowski, R. (1983). The Solar System. New York: Scientific American Library, An imprint of Scientif
American Books, Inc.

Note 2: Sources for data in Table 2 are:
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Henbest, N. (1992). The Planets: Portraits of New Worlds. New York: Nigel Viking, Penguin Group.
Kaufmann, III, W. J. (1978). Exploration of the Solar System. New York: William J.. Macmillan Publishing Co.
Smoluchowski, R. (1983). The Solar System. New York: Scientific American Library, An imprint of Scientific
American Books, Inc.

Note 3: Sources for data in Table 3 are:
Henbest, N. (1992). The Planets: Portraits of New Worlds. New York: Nigel Viking, Penguin Group.
Kaufmann, III, W. J. (1978). Exploration of the Solar System. New York: William J.. Macmillan Publishing Co.
Smoluchowski, R. (1983). The Solar System. New York: Scientific American Library, An imprint of Scientific
American Books, Inc.
http://vraptor.jpl.nasa.gov/voyager/vgrnep_fs.html

Note 4: Sources for data in Table 4 are:
Henbest, N. (1992). The Planets: Portraits of New Worlds. New York: Nigel Viking, Penguin Group.
Kaufmann, III, W. J. (1978). Exploration of the Solar System. New York: William J.. Macmillan Publishing Co.
Smoluchowski, R. (1983). The Solar System. New York: Scientific American Library, An imprint of Scientific
American Books, Inc.

Note 5: Sources for data in Table 5 are:

The New Solar System, J. Kelly Beatty and Andrew Chaikin, ed. Sky Publishing Corporation, Cambridge, MA, 1999.
The Solar System,Roman Smoluchowski. Scientific American Library. An imprint of Scientific American Books, Inc., New York, 1983.
Exploration of the Solar System, William J. Kaufmann, III. Macmillan Publishing Co, Inc., New York, 1978.
The Planets: Portraits of New Worlds, Nigel Henbest, Viking, Penguin Group. New York, NY, 1992.
Exploring the Solar System, Nicholas Booth, Cambridge University Press, 1995.
New Worlds: Discoveries from Our Solar System, Werner Von Braun, Frederick I. Ordway, Anchor Press/Doubleday, Garden City, NY, 1979.
Solar System Evolution: A New Perspective, Stuart Ross Taylor, Cambridge University Press, 1992.
Darwin Space Infrared Interferometer Project. (May 21, 1998). NSSDC Planetary Science.
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The Planets: Portraits of New Worlds, Nigel Henbest, Viking, Penguin Group. New York, NY, 1992.
Exploring the Solar System, Nicholas Booth, Cambridge University Press, 1995.
New Worlds: Discoveries from Our Solar System, Werner Von Braun, Frederick I. Ordway, Anchor Press/Doubleday, Garden City, NY, 1979.

Note 7: Sources for data in Table 7 are:

Our Solar System at a Glance, NASA Informational Summaries, June 1991.

Star Date Guide to the Solar System, The University of Texas at Austin McDonald Observatory, Damond Benningfield and Susan Schorn, Austin, TX, 1998.