



Today

- Announcements:
 - HW#9 is due April 2 at 8:00 am.
 - Submission for the Spring Break Story contest are due April 2 at 8:00 am.
- Life in the Universe – Are we alone?



Clicker Questions

- Do you believe the Earth has been visited by aliens? A- yes B - no
- Do you think there is life elsewhere in the Milky Way Galaxy besides the Earth?
A- yes B – no
- Why?



Are we alone in the Universe?

- There are approximately 200 billion other stars in the Milky Way. For reference, we can see only about 20,000 stars, and only if it is very dark.
- There are roughly 200,000,000,000 other galaxies (200 billion)
- It seems like there is plenty of opportunity for other life. Is it possible? Why haven't we seen it?
- The fields that try to answer this question are astrobiology and exobiology



There are many claims we have been visited

- From the National UFO Reporting Center
(<http://www.nuforc.org/>)

Twin Cities, MN - August 19, 2004 - 09:00-20:00 hrs.
(Central) - A very large, unidentified white object hovered over the Twin Cities area for approximately ten hours. No one, including the FAA or NWS, could identify the object.

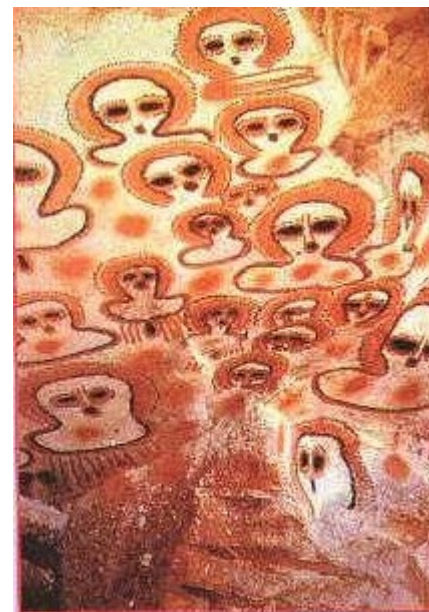
- Hundreds of supposed photos are here:
<http://www.ufoevidence.org/photographs/photohome.asp>

- According to the Gallop organization in 2000, about 33% of Americans believe we have been visited.

Ancient People Recorded Visits



6000 BC from Tassili, Sahara
Desert, North Africa



Wandjina petroglyphs from
Kimberley, Australia
About 5,000 years old
They have many stories
about sky people

Aliens in Ancient Egypt



Temple of Osiris at Abydos

The inscription clearly shows things the ancient Egyptians could not know about.



Alien Abductions

- Estimates are that 4 million Americans have been abducted. There are 10,000s of reports.
- People claim to have had similar experiences, scars, implants, etc. <http://www.alien-ufos.com/abductionstories.shtml> “Anonymous: I was woken up by loud clicking noises with to what I remember three figures standing over me piercing me or injecting something into me with a long silver instrument I did not feel pain but I did have an overwhelming feeling of tingles throughout my whole body I don't know how I got there or how I got out but I can assure you this was no dream and I have the unexplainable scars to prove it. “
- Famous examples Betty and Barney Hill (1961) who were visited by beings who said they were from Zeta Reticuli. The star Zeta Reticuli was not discovered until 1969!



Are these true? We don't know

- Hypnosis is an unreliable method to reconstruct memory. There are many studies that show false memories can be produced.
- The Hills (1961) recalled most of their story under hypnosis a few years after the abduction. Barney Hill reported that the aliens had "wraparound eyes," a rather unusual feature. However, twelve days earlier an episode of "The Outer Limits" featured just such an alien being. According to Robert Schaeffer, "we can find all the major elements of contemporary UFO abductions in a 1930 comic adventure, Buck Rogers in the 25th Century."
- No physical evidence exists for alien abductions. For example, No one has volunteered to have their "implants" studied.
- Stars in constellations are named by a letter of the Greek alphabet followed by the Latin form of the constellation name. There are millions of stars in each constellation.



Reconstructed Memory from Hypnosis

Comprehensive Textbook of Psychiatry (8th edition):

'An overwhelming body of research indicates that hypnosis does not increase accurate memory, but does increase the person's willingness to report previously uncertain memories with strong conviction. Furthermore, the hypnotized individual has a pronounced tendency to confabulate in those areas where there is little or no recollection; to distort memory to become more congruent with beliefs . . . and fantasies; and to incorporate cues from leading questions as factual memories. Finally there is a high likelihood that the beliefs of the hypnotist will somehow be communicated to the patient in hypnosis and incorporated into what the patient believes to be memories, often with strong conviction.'

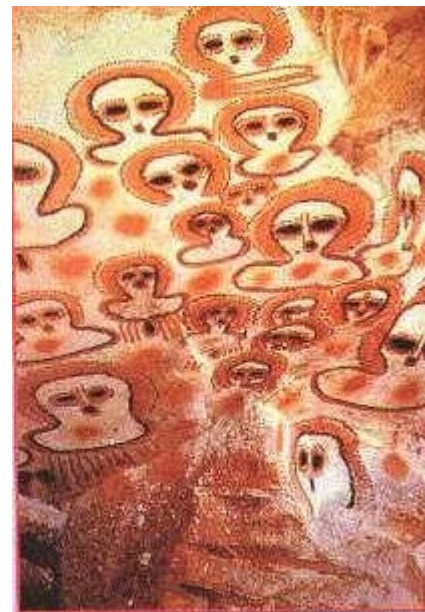
ISBN: 0-7817-3434-7 Pub Date: November 2004

Confabulate - To fill in gaps in one's memory with fabrications that one believes to be facts.

Ancient People Recorded Visits



People cover their heads for protection from sun and wind



The Wandjina people worshiped cloud gods.

Aliens in Ancient Egypt



Temple of
Osiris at
Abydos

Actually the images are the result of chance. It is a combination of carving over old hieroglyphics and having some of the filling fall out



"The one of the Two Ladies, who suppresses the nine foreign countries."



What to do

- Keep an open mind
- Be skeptical if there are warning signs (this is always good advice)
- Follow the scientific method – think of tests and perform them
- For reference: In 1692 20 people were put to death, perhaps 13 died in prison, and 140 were accused of witchcraft in Salem, MA.
- “Exceptional claims require exceptional proof”
– Carl Sagan

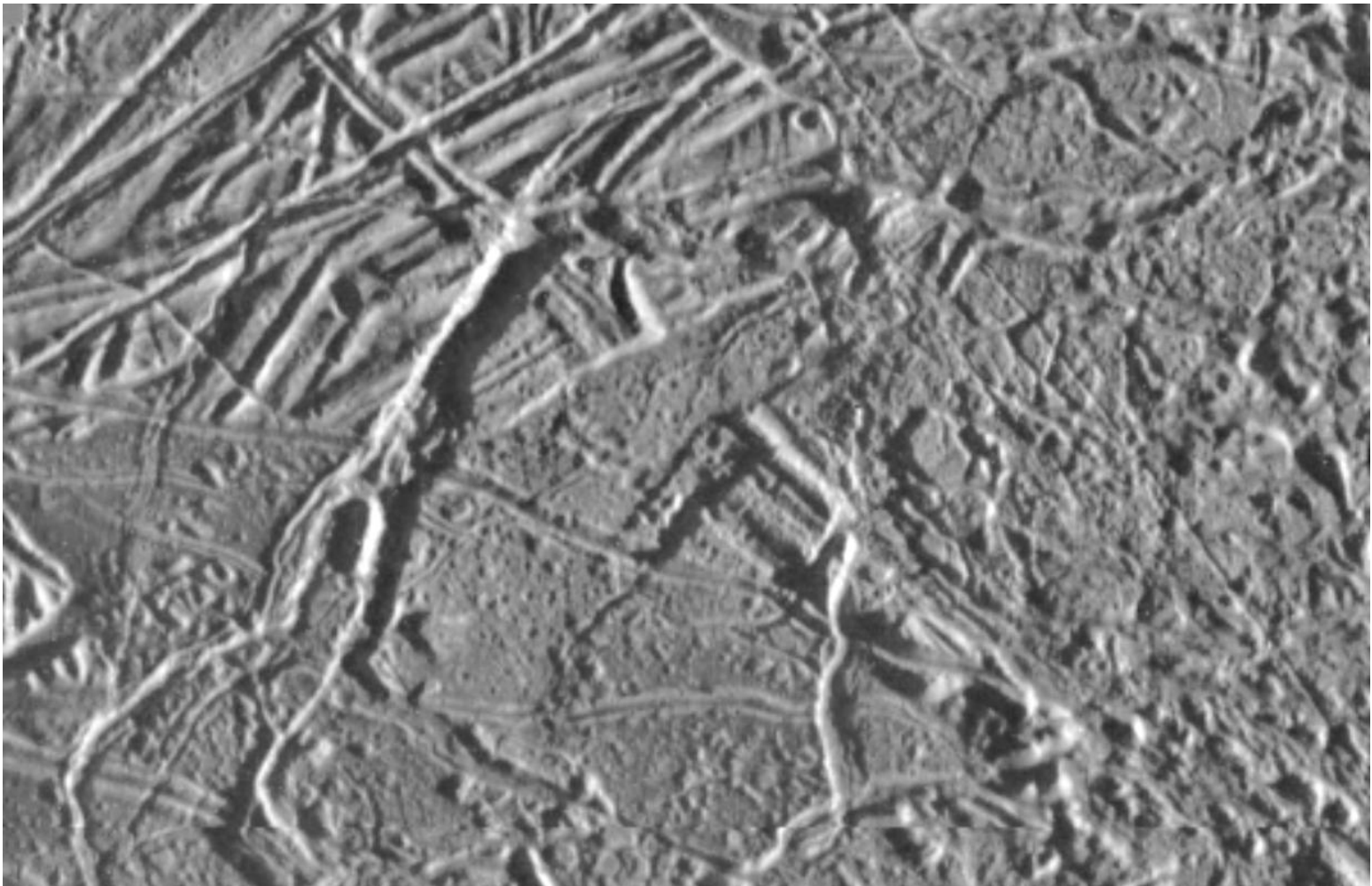


Life in our solar system

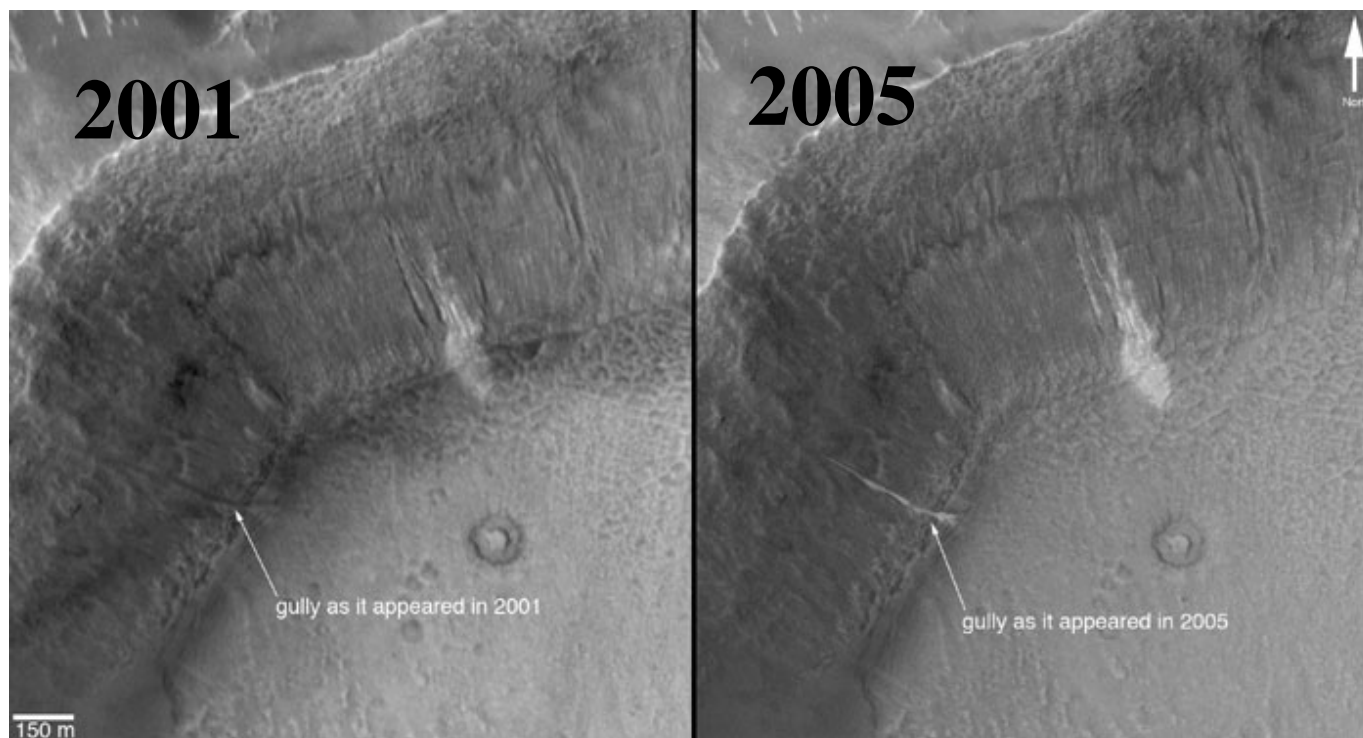
- The one ingredient necessary for life on Earth is Water.
- Life started on Earth almost as soon as possible about 3.5 billion years ago. It took almost 2 billion year for complex life forms to evolve.
- Based on our bias, we want to look for other places for liquid water: maybe Mars, or moons of Jupiter (Europa, Callisto)



Surface of Europa (moon of Jupiter)



Water on Mars?



Mars Global Surveyor's Mars Orbiter Camera show recent flows of water on Mars.

Around 3 billion years ago Mars had lots of water.



Drake Equation

The Drake Equation was developed by Frank Drake in 1961 as a way to focus on the factors which determine how many intelligent, communicating civilizations there are in our galaxy.

Number of civilizations to communicate with = $N^* f_p n_e f_l f_i f_c f_L$

N – number of stars in the Milky Way (200 billion)

f_p - fraction of stars with planets (0.2 to 0.4)

n_e – number of planets where life may exist per star (1 to 5)

f_l – fraction where life begins (1)

f_i – fraction of life that develops intelligence (0 to 1)

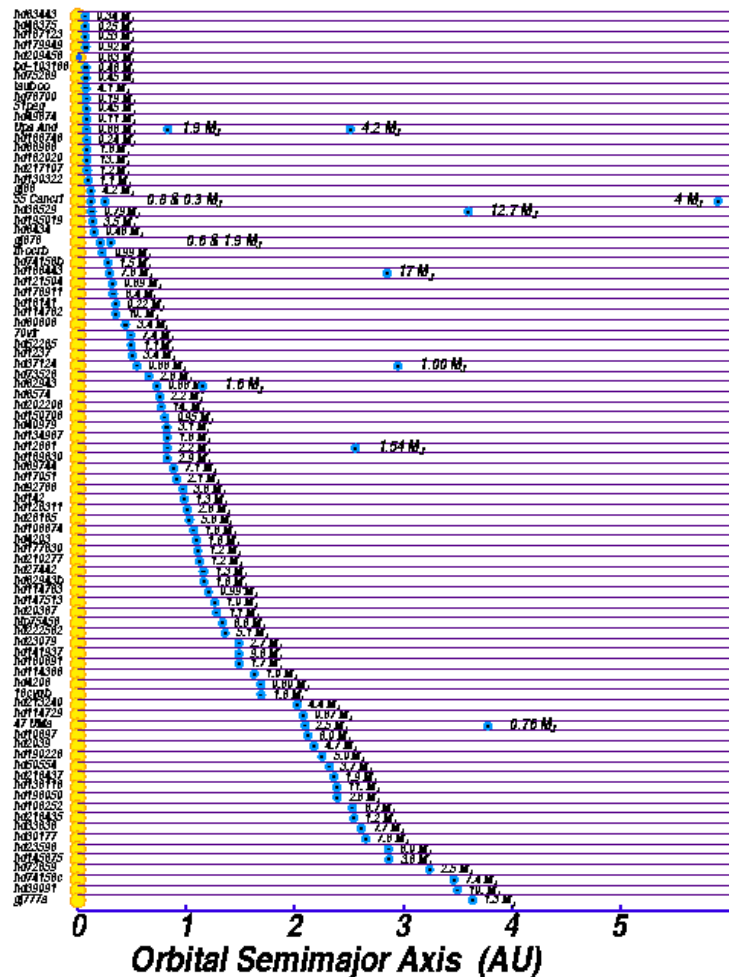
f_c – fraction of intelligent life that develops a method of communication (0.1)

f_L – fraction of a star's life when intelligent life survives (10^{-8} to 0.5)

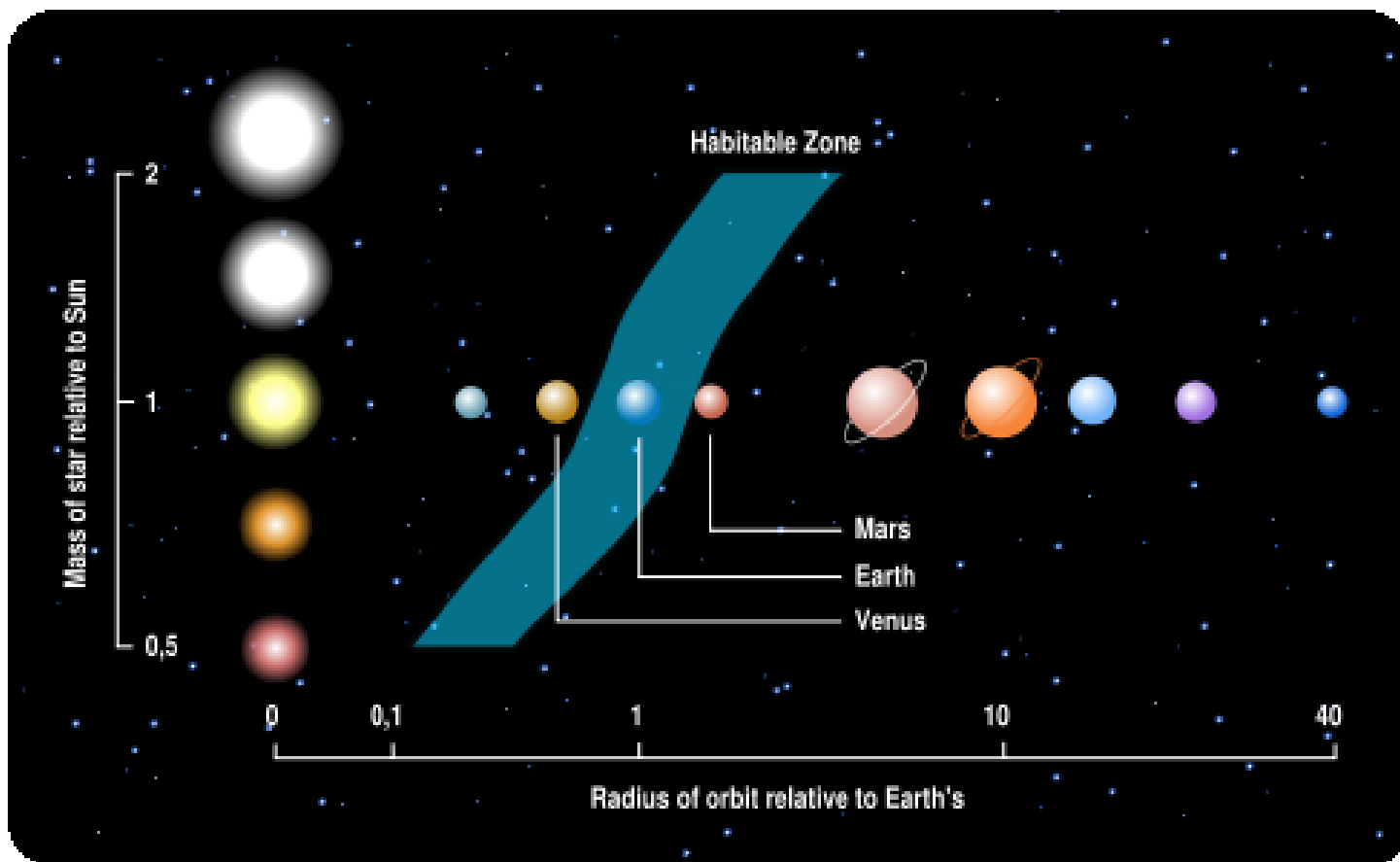
Fraction of Stars with Planets

Extra solar planets

- There have been 277 planets discovered outside our solar system orbiting other stars.
- One of the recent ones is 250 ly away, is the size of Neptune but is very close to the star and orbits it in only 4 days.



Number of planets per star that may have life





Other factors

- fraction where life begins – On Earth this happened almost as soon as it was possible (1)
- fraction of life that develops intelligence – We have only one example and it worked here (1)
- fraction of intelligent life that develops a method of communication – of the few intelligent species on Earth one did it (0.01)
- fraction of a star's life when intelligent life survives – so far we only have a record of 100 years out of 4.5 billion (10^{-7})



Problems

- Will be be able to recognize other life and communicate with it?
- The distances are large. The nearest stars are 4 light-years away. Most in the Milky Way are 30,000 ly away. Text messaging will be hard.
- It takes several years to reach Jupiter (the nearest star is 100,000 times farther away)
- SETI is an attempt to search for communication:
<http://www.seti.org/>



What does this all mean?

- It is possible that in all the Universe we are the most intelligent beings – that does make each of us remarkable
- Maybe there hasn't been time for other technological civilizations to develop
- Maybe they are just too far away to communicate