Honors 228: Astrobiology using Bennett and Shostak

Chapter 12 overview + some thoughts from another prof
Spring 2009
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What’s talked about

- The Drake Equation (12.1)
- The Question of Intelligence (12.2)
- Searching for Intelligence (12.3)
- The Process of Science in Action: UFOs and Aliens on Earth (12.4)

It's a Big Galaxy in a Big Universe

Extrasolar Capability Review

Extrasolar Planets

What are the odds?

- Drake Equation
  - Odds of planets
  - Odds of Earth-like planet
  - Odds of life
  - Odds of civilization
  - Longevity of civilization
The Drake Equation

\[ N = R \times f_p \times n_e \times f_l \times f_i \times f_t \times L \]

- \( f_i \): fraction of those life-bearing planets on which intelligence evolves
- \( f_t \): fraction of those intelligent-life planets that develop technological society
- \( L \): average lifetime of a technologically competent civilization.

The Rate of Star Formation

We can estimate the average number of stars forming each year in the Galaxy simply by noting that at least 100 billion stars now shine in the Milky Way. Dividing this number by the 10-billion-year lifetime of the Galaxy, we obtain a formation rate of 10 stars per year. This may be an overestimate because we think that fewer stars are forming now than formed at earlier epochs of the Galaxy, when more interstellar gas was available. However, we do know that stars are forming today, and our estimate does not include stars that formed in the past and have since exploded, so our value of 10 stars per year is probably reasonable when averaged over the lifetime of the Milky Way. HST has provided us with a value of 20 stars per year.

Fraction of Stars with Planets

- Accepting the condensation theory and its consequences, and without being either too conservative or naively optimistic, we assign a value near 1 to this term - that is, we believe that essentially all stars have planetary systems.
- A caveat: Note that extrasolar planets have very different characteristics than the planets of the Solar System.

The Number of Habitable Planets Per Star

- Estimate 1 planet in 10 would be a habitable planet
- Eliminate planets around the short lived stars
- Most likely candidates are stars somewhat similar to the Sun (F,G,K)
- Long lived; fairly large habitable zone
- This means (combining probabilities) the number of habitable planets per star is between 0.1 and 0.01

Fraction on which Life arises

- If we accept the mediocrity principle then this fraction is 1.
- It could be as low as 0 if one believes life is rare.

Intelligent Life

- One school of thought maintains that, given enough time, intelligence is inevitable. In this view, assuming that natural selection is a universal phenomenon, at least one organism on a planet will always rise to the level of "intelligent life." If this is correct, then the fifth term in the Drake equation equals or nearly equals 1.
- Others argue that there is only one known case of intelligence, and that case is life on Earth. For 2.5 billion years – from the start of life about 3.5 billion years ago to the first from the start of life about 3.5 billion years ago to the first appearance of multicellular organisms about 1 billion years ago – life did not advance beyond the one-celled stage. This would mean the fraction is close to 0.
Technology

The anthropomorphic view: if we do it every one else will so the fraction is 1.
The view of the dolphins: show me the fish. The fraction is close to 0.

Lifetime of Civilizations

Guess
- We blow ourselves up: 75 years
- We do not blow ourselves up – your guess is as good as mine
- > 100 years or > 100000 years?

Putting in the Numbers

Unless one is pessimistic the fractions are all of order 1 so we get
N = 1 * Lifetime
So we get 10's to 1000's of civilizations
But now consider the distances between the civilizations!!!

iClicker Question

The end result of a calculation with Drake equation is intended to be an estimate of
A the number of worlds in the galaxy on which life has arisen.
B the number of worlds in the galaxy on which intelligence has arisen.
C the number of worlds in the galaxy on which civilizations are transmitting signals now.

What is intelligent life?

How do you measure intelligence?
- IQ Intelligence Quotient
- EQ Encephalization Quotient

Are humans only intelligent species on Earth?
- Great apes and chimpanzees
  - do they have a sense of “I”
An Intelligence Quotient or IQ is a score derived from one of several different standardized tests attempting to measure intelligence. The term "IQ," a translation of the German Intelligenz-Quotient, was coined by the German psychologist William Stern in 1912 as a proposed method of scoring early modern children’s intelligence tests such as those developed by Alfred Binet and Theodore Simon in the early 20th Century. Although the term "IQ" is still in common use, the scoring of modern IQ tests such as the Wechsler Adult Intelligence Scale is now based on a projection of the subject’s measured rank on the Gaussian bell curve with a center value (average IQ) of 100, and a standard deviation of 15 (different tests have various standard deviations; the Stanford-Binet IQ test has a standard deviation of 16).

**iClicker Question**

The fact that marine predators like dolphins and sharks have similar shapes despite different ancestry is an example of

- A. convergent evolution.
- B. narrow bandwidth.
- C. spontaneous creation.

**iClicker Question**

Which of the following would lead an animal to a higher encephalization quotient (EQ) as it evolved?

- A. Growth in both body size and brain size.
- B. Growth in body size but not in brain size.
- C. Growth in brain size but not in body size.

**Where look? The Water Hole**
Past Searches

How Far Can We Go?

Looking for Life

One Form of Communication

Another Form of Communication
Is this really how it’s done?

One Way It’s Done

Arecibo Message

What does it mean

-Decoded Arecibo Message

iClicker Question

Two-way conversation with other societies is probably unlikely, even if we make contact. This is mainly because

- A aliens won’t speak our language.
- B it might be dangerous to get in touch.
- C the time it takes for signals to cross the distance to them could be centuries or more.
iClicker Question

One reason the scientists doubt that crop circles have alien origin is
A they are always beautiful.
B they can be easily made by humans.
C their appearance is not correlated with sightings of bright lights.

And Now a Word From Dr. Zimmerman
Lost Tribes, Sunken Continents, and Ancient Astronauts
On the Wild Side of Midwestern Archaeology

Larry Zimmerman
Department of Anthropology/Museum Studies
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Why Search Elsewhere
When
The Midwest has it all?

Ancient Mysterioso?

Why People Believe Weird Things

Fun
- Fantasy and escapism
- The truth is too simple
- Mistrust of science
- Poor science education
- “Received” wisdom

Purposes of this lecture:
1. To show some examples of fantastic archaeology in the Midwest
2. To provide some tools for examining fantastic claims
3. To have some fun

The Mound Builders
The Archaeology of a Myth

The Core belief: Indians could not have built the mounds and other amazing earthworks, therefore someone else must have.
Who? Almost anyone—Irish, Scandinavians, Libyans, Tartars, Lost Tribes of Israel, and many others
Why? Lack of reliable data, theological modes of explanation, non-existence of a tradition of scientific thought, a continuing sense of wonder at the exotic nature of the New World

The Result?
Wild speculation
A European (i.e., white) History of America?

There was an apparent need for an heroic past that would resemble that of Europe. The reasons are complex:

- The colonists were in one sense a “people without a history”
- Those living in Europe thought that something must be wrong with the environment here to cause such revolutions
- Needed a “white” history to claim the land - a precursor to Manifest Destiny

Goodbye to the Mound Builders

Or was it?

Mound Builder Survivals

Diffusionists

Hoaxes

Hoaxes thrived in the late 1800s

- Social contexts similar to Mound Builder Myth

Graham Hancock’s Lost Civilization at 12,500 BP

Ignatius Donnelly and Atlantis, 1882

Barry Fell and Epigraphy

Piltdown Man, 1912

Cardiff Giant, 1868:
An Iowa Connection

“There’s a sucker born every minute.”
David Hannum
Hoax or not?  
The Kensington Runestone  
Olaf Ohman, 1898

They really got around!
- Kensington Runestone - April 24th, 1362
- Heavener Runestone - November 11th, 1012
- Poteau Runestone - November 11th, 1017
- Shawnee Runestone - November 24th, 1024
- Tulsa Runestone - December 2nd, 1022

“2nd Minn. Runestone a hoax, say carvers”

AVM stone inscription

Just how many Vikings came?

This book says there are now fewer than 42 Viking settlements in Chickasaw, Howard, and Mitchell Counties in Iowa and Mower County in Minnesota.

Apparently, quite a few!

Map of the grave of 12 Vikings found by dowsing near Spring Grove, MN

On the Wild Side of Midwestern Archaeology

The Minnesota Iceman

Artist Lee Krystek’s conception of the Iceman

Frank Hansen and the Iceman

On the Wild Side of Midwestern Archaeology

There were giants in the earth in those days… (Gen.6:1-4)

George W. Hill, M.D., dug out a skeleton “of unusual size” in a mound of Ashland County, Ohio. In 1879, a nine-foot, eight-inch skeleton was excavated from a mound near Brewersville, Indiana. The bones, which were stored in a grain mill, were swept away in the 1937 Flood (Indianapolis News, Nov 10, 1975).

Could this be the remains of one?

Photo is a 2004 Web hoax

On the Wild Side of Midwestern Archaeology

The Saga of Burrows Cave—Olney, Illinois

A cache of Mauritanian coins from the cave

A Mauritanian worship

The Crucifixion

Sea of the relatively few marble slabs removed from the Illinois site portrays either a Mauritanian ruler or high priest of the 1st century A.D.

On the Wild Side of Midwestern Archaeology
Bigfoot and Other Critters

- Mike Quast and Bigfoot sightings in Minnesota
- A few of the reported monsters in the Midwest:
  - Illinois: The Hardin Monster, Murphyboro Mud Monster
  - Indiana: The Beast of Buss (Charlestown), The Crawfordsville Monster; 30 reported Bigfoot sightings since 1997, the majority in southern Indiana
  - Wisconsin: The Lake Koshkonong Monster, Lang Lake, Elkhart Lake, Lake Geneva, Lake Kegonsa, Lake Michigan, Oconomowoc Lake, Pewaukee Lake, Red Cedar Lake, Rock Lake, Lake Superior, Sturgeon Lakes, Mendota and Monona in Madison

Based on the painter George Catlin's comments:
- The Mandans spoke Welsh (he didn’t know Welsh!)
- They used a boat which was know as the Welsh Coracle
- Many of the Mandans had blond hair and blue eyes

Prince Madoc: The Founder of Clark County Indiana

- and progenitor of the Mandan Indians of the Missouri River

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Ancient Astronauts and The Pyramids of Rock Lake, Wisconsin

- In his books (lower right), Erich von Daniken (below) suggests that many of the earth’s monuments were built by ancient astronauts. Could Wisconsin’s pyramids have been built by ancestors of the occupants of this UFO (right) reported in West Central Minnesota, November, 2003?

Whats’ the Harm?

- Many diminish human abilities & accomplishments.
- They deprive people of knowledge about their real history.
- They draw away funding from scientific research.
- Belief in pseudoscientific ideas about “harmless” notions supports belief in pseudoscientific belief about harmful notions, such as false medical claims.

- Other than that, not much.

Recognizing Pseudoscientific Claims about the Past

- Sometimes you can read a book by its cover!

- Are seemingly outrageous claims made?
- Does the claimant have any training or credentials in the subject about which the claim is made?
- Are leading questions being asked?
- Are real scientists talking about it?

- Be a skeptic!

A Skeptic’s Tools

- Always keep an open mind, but consider:
  - Irrefutable hypothesis
  - Argument by authority
  - Appeal to myth
  - Argument by spurious similarity
  - Heresy does not equal correctness
  - Occam’s razor
  - Extraordinary claims demand extraordinary proof
  - Good old common sense

- http://www.skeptic.com
- http://www.csicop.org/si/
- http://homepages.wmich.edu/~korista/baloney.html
Satan’s Corpse in South Dakota?

Finally, there is proof. Aliens believe in Skeptics.