

## Description

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. The Drake Equation is:

$$N = N^* f_p n_e f_i f_c f_L$$

The equation can really be looked at as a number of questions:

**N\*** represents the number of stars in the Milky Way Galaxy

**Question:** How many stars are in the Milky Way Galaxy?

**Answer:** Current estimates are 100 billion.

**f<sub>p</sub>** is the fraction of stars that have planets around them

**Question:** What percentage of stars have planetary systems?

**Answer:** Current estimates range from 20% to 50%.

**n<sub>e</sub>** is the number of planets per star that are capable of sustaining life

**Question:** For each star that does have a planetary system, how many planets are capable of sustaining life?

**Answer:** Current estimates range from 1 to 5.

**f<sub>i</sub>** is the fraction of planets in **n<sub>e</sub>** where life evolves

**Question:** On what percentage of the planets that are capable of sustaining life does life actually evolve?

**Answer:** Current estimates range from 100% (where life can evolve it will) down to close to 0%.

**f<sub>i</sub>** is the fraction of **f<sub>i</sub>** where intelligent life evolves

**Question:** On the planets where life does evolve, what percentage evolves intelligent life?

**Answer:** Estimates range from 100% (intelligence is such a survival advantage that it will certainly evolve) down to near 0%.

**f<sub>c</sub>** is the fraction of **f<sub>i</sub>** that communicate

**Question:** What percentage of intelligent races have the means and the desire to communicate?

**Answer:** 10% to 20%

**f<sub>L</sub>** is fraction of the planet's life during which the communicating civilizations live

**Question:** For each civilization that does communicate, for what fraction of the planet's life does the civilization survive?

**Answer:** This is the toughest of the questions. If we take Earth as an example, the expected lifetime of our Sun and the Earth is roughly 10 billion years. So far we've been communicating with radio waves for less than 100 years. How long will our civilization survive? Will we destroy ourselves in a few years like some predict or will we overcome our problems and survive for millennia? If we were destroyed tomorrow the answer to this question would be 1/100,000,000th. If we survive for 10,000 years the answer will be 1/1,000,000th.

When all of these variables are multiplied together when come up with:

**N**, the number of communicating civilizations in the galaxy.

The real value of the Drake Equation is not in the answer itself, but the questions that are prompted when attempting to come up with an answer. Obviously there is a tremendous amount of guess work involved when filling in the variables. As we learn more from astronomy, biology, and other sciences, we'll be able to better estimate the answers to the above questions. Many of these questions will be addressed in depth in future issues of **Enigma**.