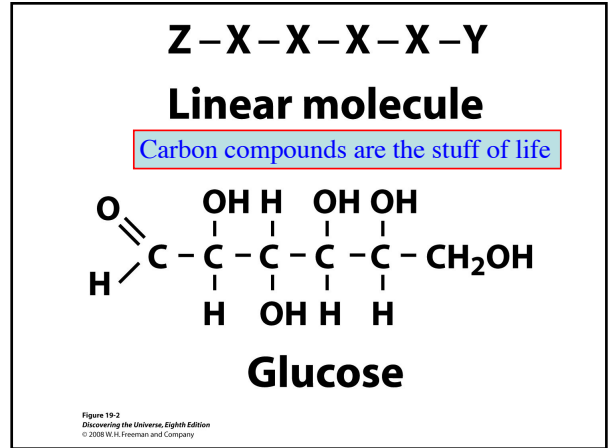


1



2

Biology based on organic molecules with silicon compounds?

Bad qualities - reactions take far too long to support the evolution of life

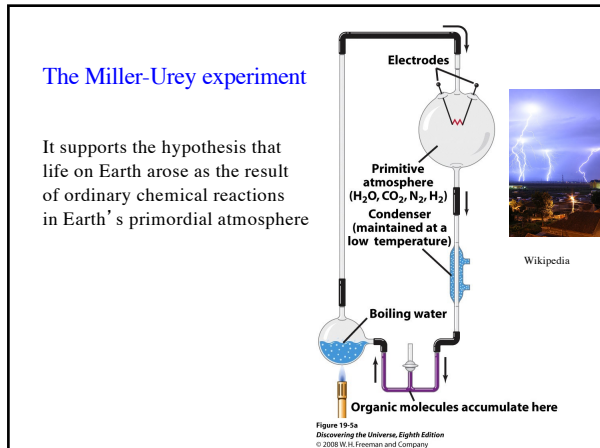
Figure 19-3
Discovering the Universe, Eighth Edition
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3

Meteorites – with organic molecules

Figure 19-4a
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4



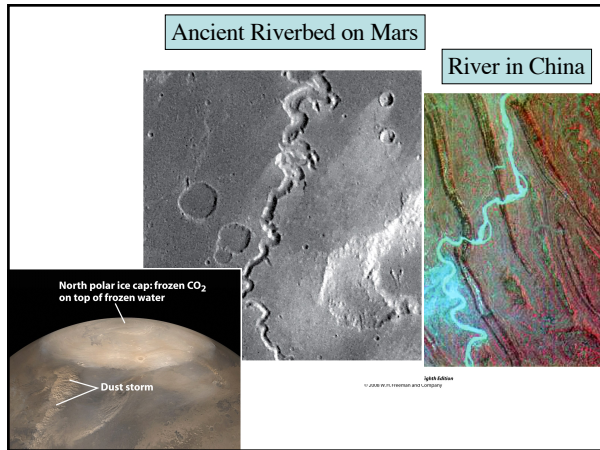
5

Life can develop in very hostile environments

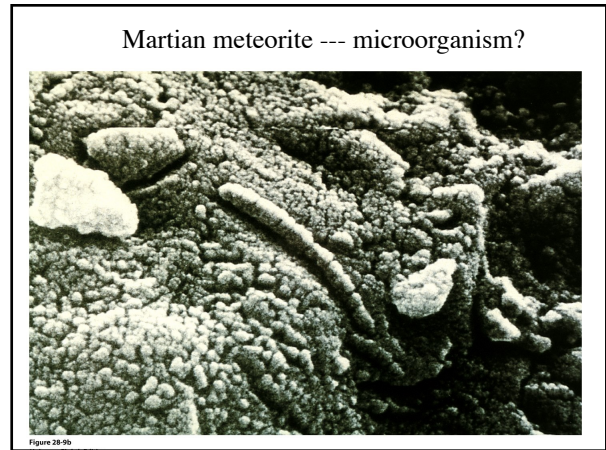
Tube worms in 3km deep ocean in almost boiling water near vents

Figure 19-7b
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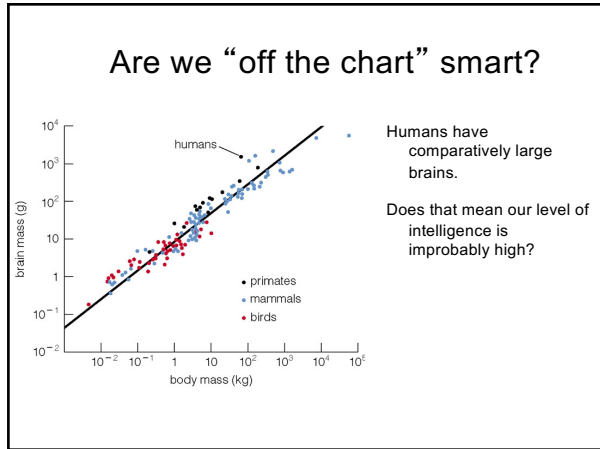
6



7



8



9

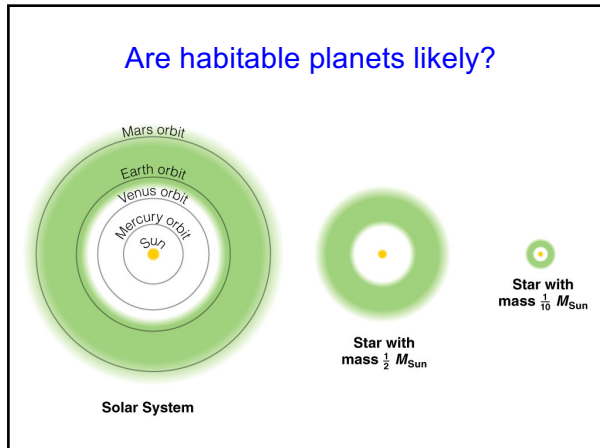
The Drake equation

$$N = R f_p n_e f_i f_c L$$

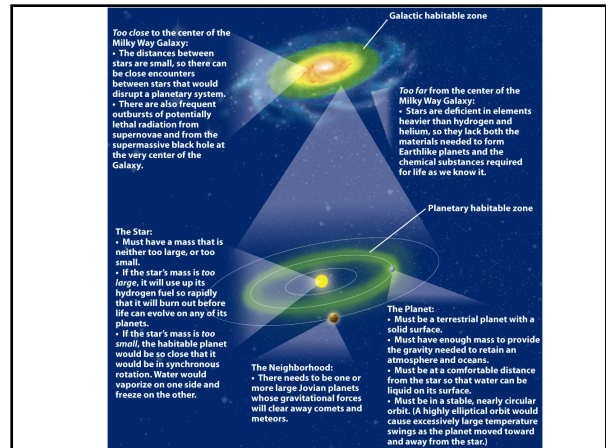
A photograph of a man in a suit pointing at a whiteboard. The whiteboard has the Drake equation written on it: $N = R f_p n_e f_i f_c L$.

N: number of technologically advanced civilisations
 R: rate at which solar-type stars form in the galaxy
 f_p: fraction of solar-type stars that have planets
 n_e: number of planets per solar-type star suitable for life
 f_i: fraction of such planets with life
 f_c: fraction of those lifeforms that evolve into intelligent species
 f_c: fraction of those species that send signal to us
 L: lifetime of such species

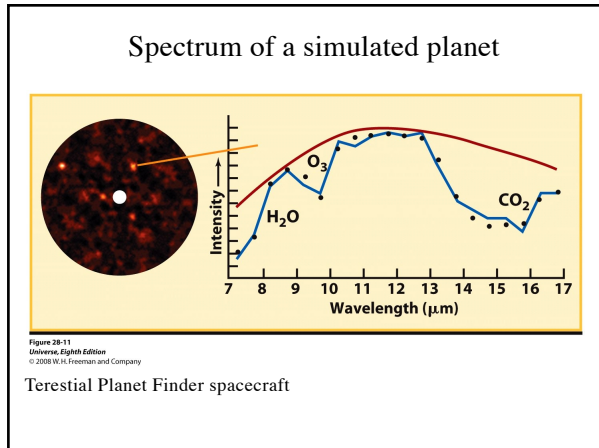
10



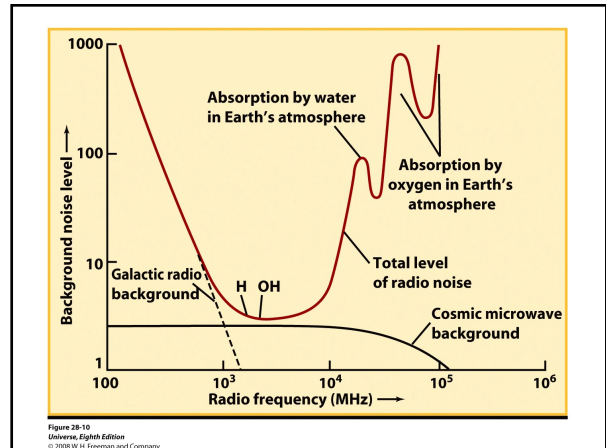
11



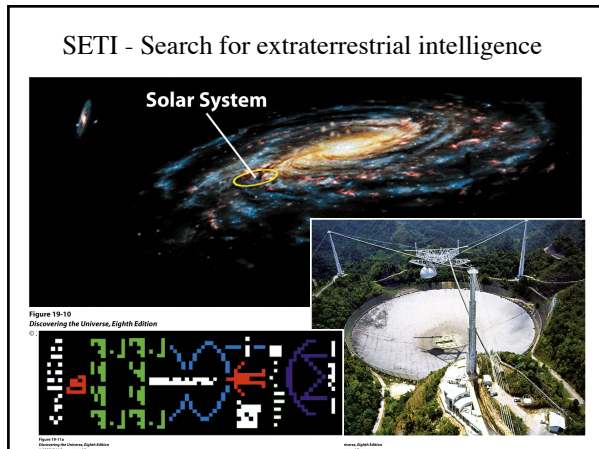
12



13



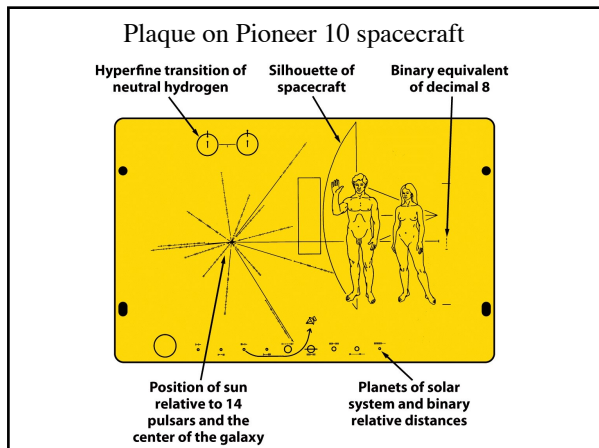
14



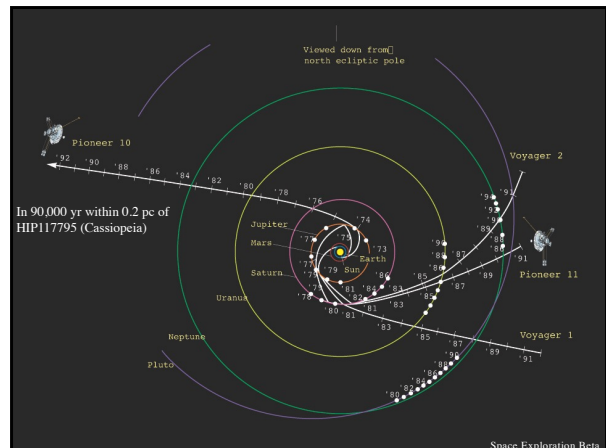
15

...but, sad as it is....
 no response from extraterrestrials yet.

16



17



18

How long till Pioneer 10
gets caught in the orbit of a star?

19

1,000,000,000,000,000,000 years

20



21