A TAXONOMY OF INFORMATION AND THE DESIGN INFERENCE

American Scientific Affiliation
Symposium: Information, Genetics and Origins of Life
July 21, 2012

–

By Stephen Meyer, William Dembski, and
Casey Luskin
B.S., M.S., J.D.
Research Coordinator, Center for Science & Culture
Discovery Institute

CENTER FOR SCIENCE & CULTURE | discovery.org/csc

OUTLINE:

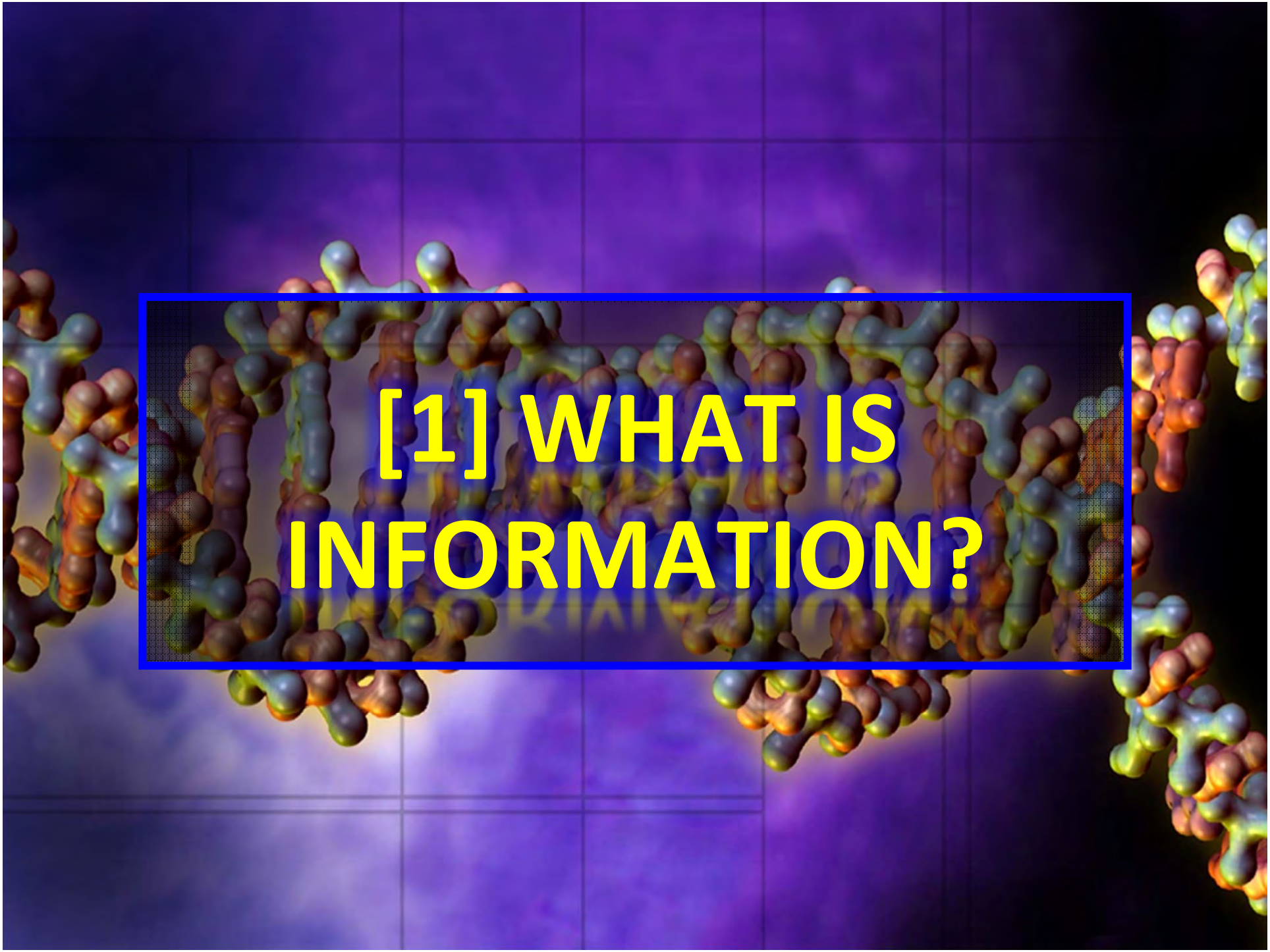
[1] What is Information?

[2] Syntactic Information

[3] Shannon Information, Etc..

[4] Semantic Information

[5] Complex-Specified Information (CSI) and the Design Inference


[1] WHAT IS
INFORMATION?

[1] WHAT IS INFORMATION?

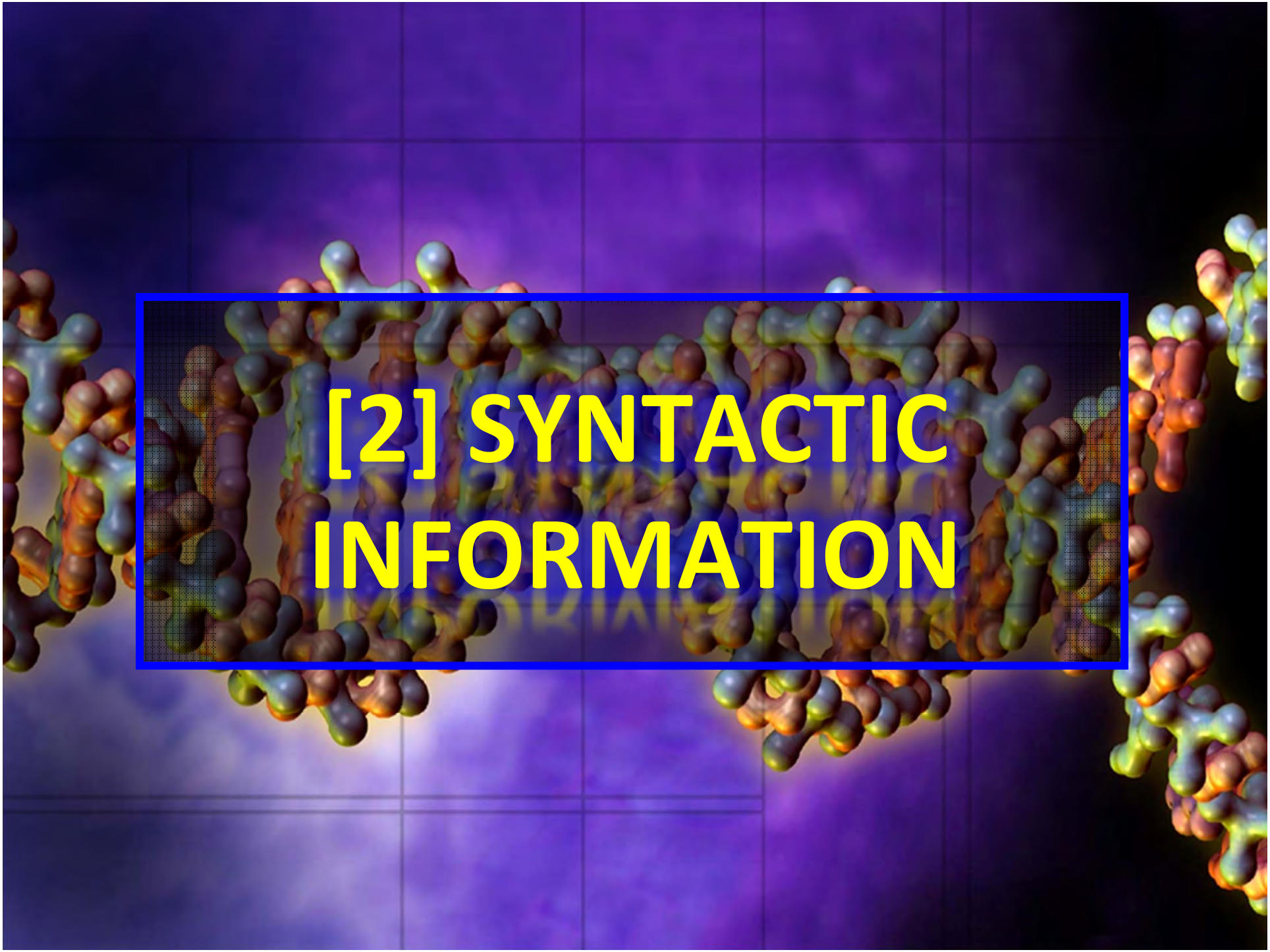
- Not always easy to define.
- Information is a measure of randomness vs. nonrandomness.
- The fundamental intuition behind information is a reduction in possibilities.
- The more you rule out, the more information you've conveyed.

[1] WHAT IS INFORMATION?

- Nature can produce information. But intelligent agents also can.
- To put it another way: The reduction in uncertainty could occur by an intelligent agent, or through a physical occurrence

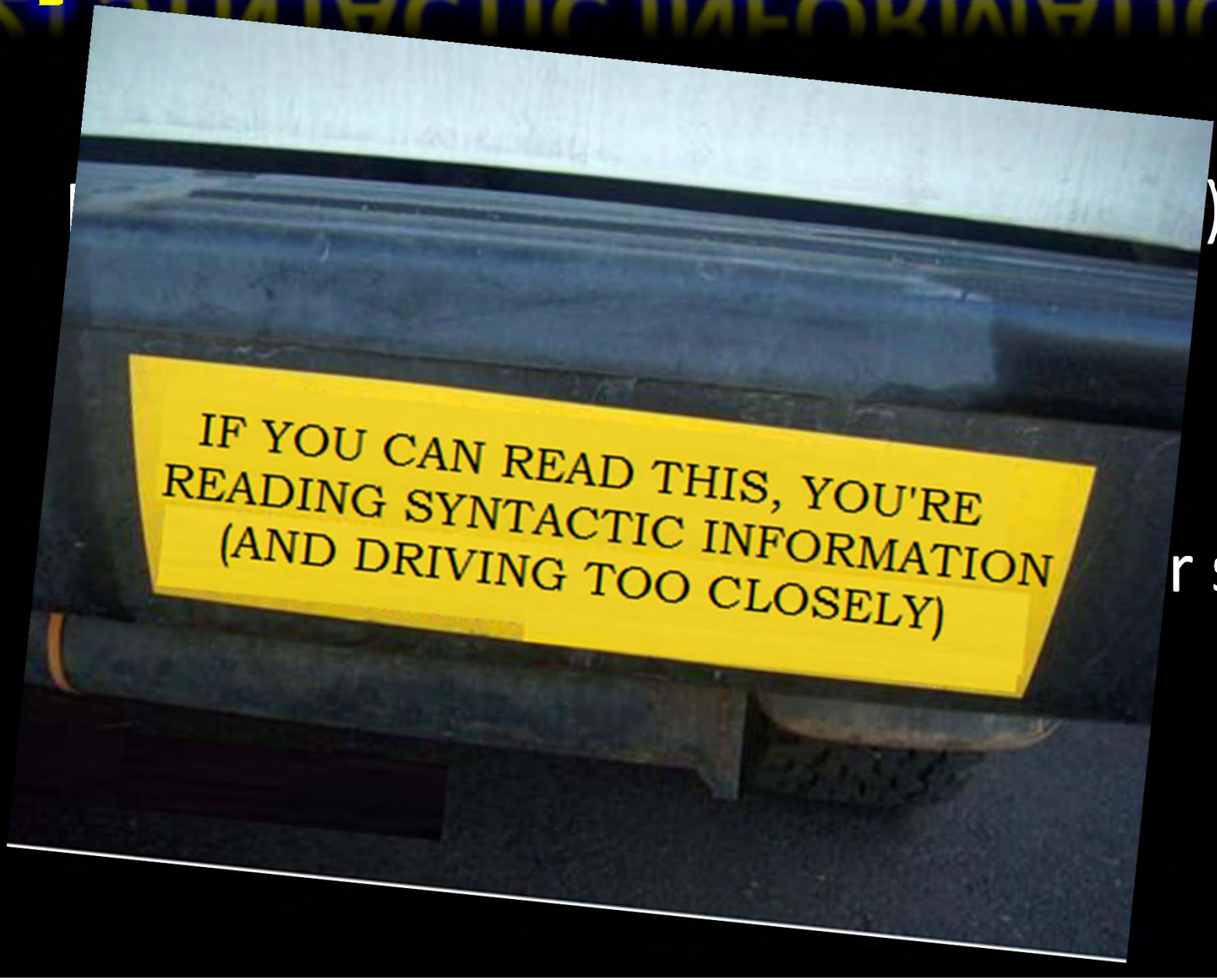
Nature:
Blue sky reduces uncertainty about whether it is raining

Human:
18 people playing baseball outdoors reduces uncertainty about whether it is raining


[2] SYNTACTIC
INFORMATION

[2] SYNTACTIC INFORMATION

- [illegible])
- r set




[3] SHANNON
INFORMATION

[3] SHANNON INFORMATION

- Pertains to syntactic information, using a fixed character set, with characters in a sequence.
- Once you have that fixed character set, you can start asking about probabilities.
- Measured in bits. bits = - Log_2 p
- Purpose is to help measure fidelity of transmission of information.

[3] SHANNON INFORMATION

- The string 00110 contains 5 bits. “5 bits” tells you nothing about its content or meaning.
- Shannon Information is only concerned with reduction in uncertainty.
- It is not concerned with content, pattern specification, or “meaning.”

[3] SHANNON INFORMATION

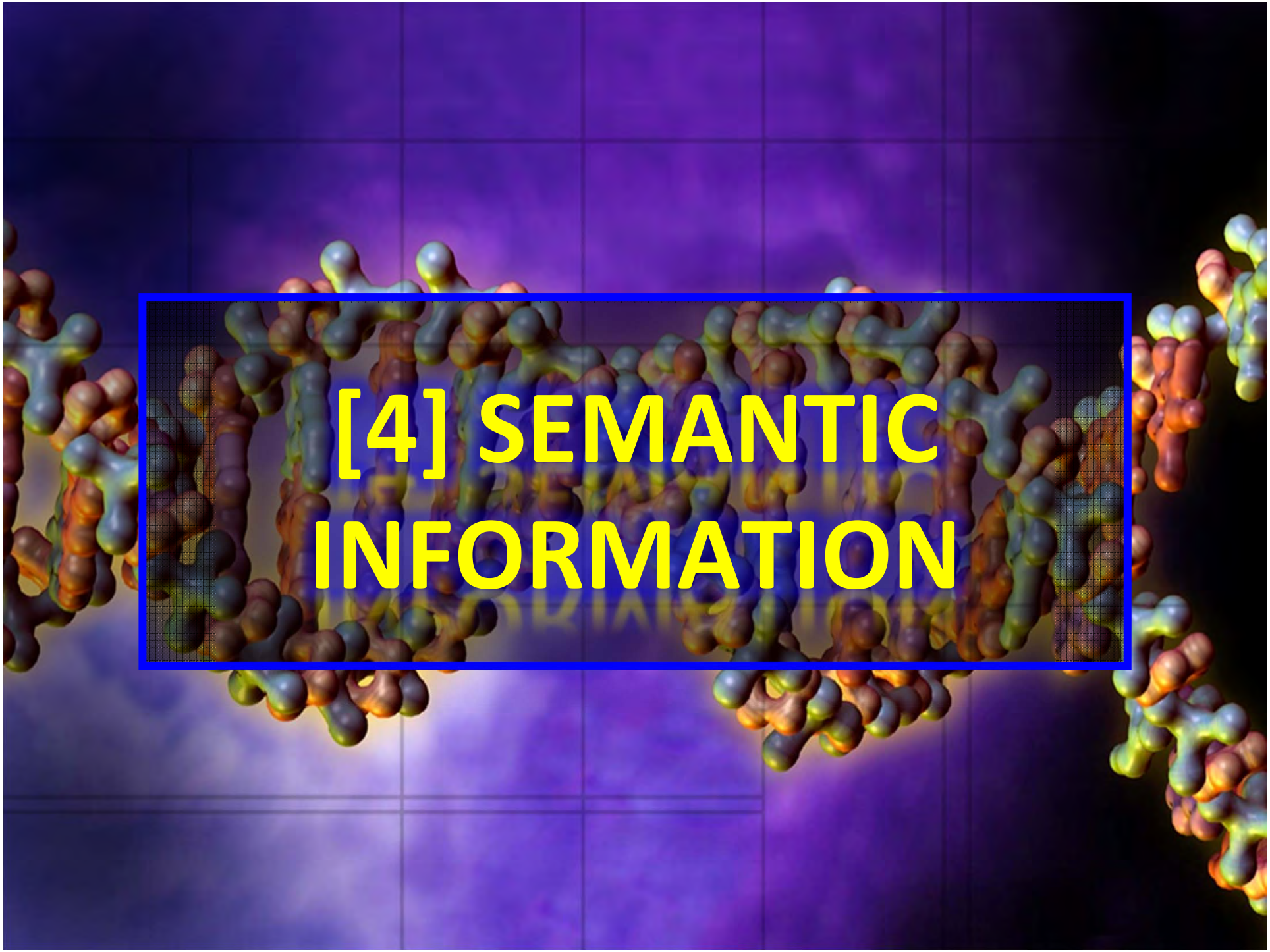
Co

The Random and Non-Random Strings have the Same Amount of Shannon Information—103 bits!

Shannon Information does not help you distinguish between functional and non-functional information.

[3] KOLMOGOROV COMPLEXITY

- N
- 1111111111111111111111111
  1111111111111111111111111
  → Repeat "1" 57 times
- KOMOLGOROVINFORMATIONISAPOOR
  MEASUREOFBIOLOGICALCOMPLEXITY
  → Compress by removing vowels?
- JLNNUKFPDARKSWUVWEYTYKARRBVCLT
  LOPDOUUMUEVCRLQTSFFWKJDXSOB
  → Not compressible.
- Consider 3 string


[4] SEMANTIC
INFORMATION

[4] SEMANTIC INFORMATION

- Definition: Information that has meaning.

Semantic information indicates "the significance of a message, whether or not an intelligent agent was involved."
—Randy Isaac, "Information, Intelligence and the Origins of Life," (*PSCF* 63(4):219-230 (Dec. 2011).)

-> Where does meaning come from? We assign it.

[4] SEMANTIC INFORMATION

- This is not what Shannon had in mind, and it's really NOT what's at stake with complex and specified information.
- CSI is identifying some specified subset (a pattern) within a reference class of possibilities. It's not necessarily looking at the meaning, and it doesn't have to be a "message."

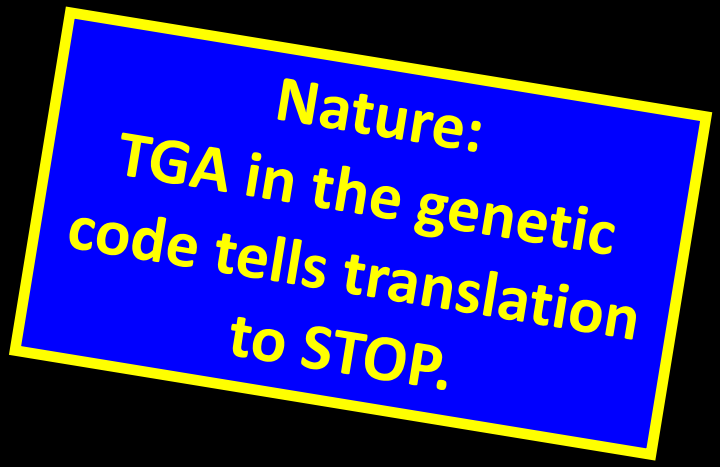
[4] SEMANTIC INFORMATION

"In abstract symbolism, the symbol has a meaning assigned to it which does not necessarily derive from its physical properties."

(Isaac, 2011)

[4] SEMANTIC INFORMATION

- Semantic information could occur by a natural cause, or by intelligence:



[4] S…NTIC INFORMATION

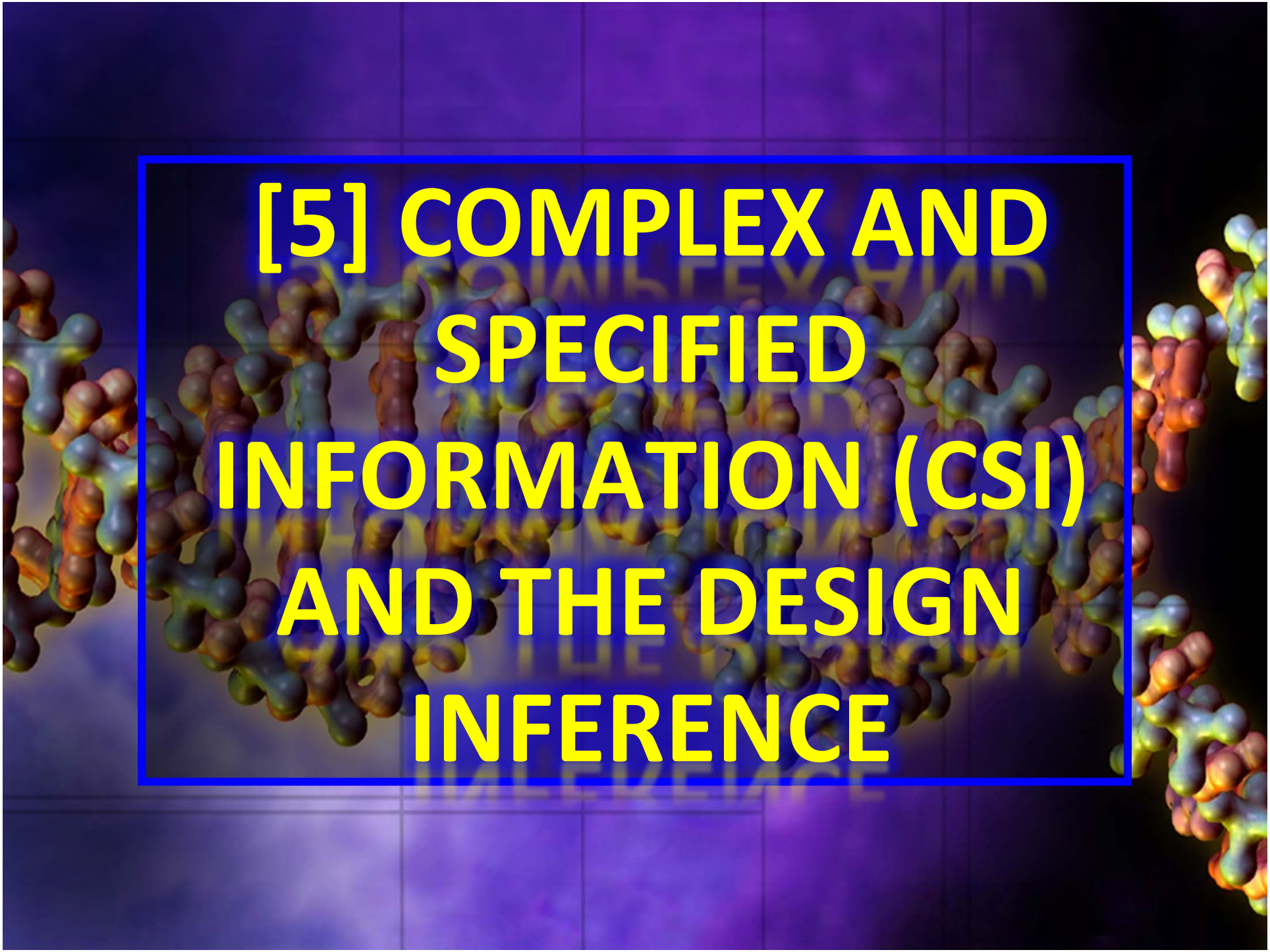
- "C…
  n… …e
  c…
  s…
- "…rk

…011)

Yes!

TGA

Why should the genetic code be excluded from abstract symbolism that is semantic information?

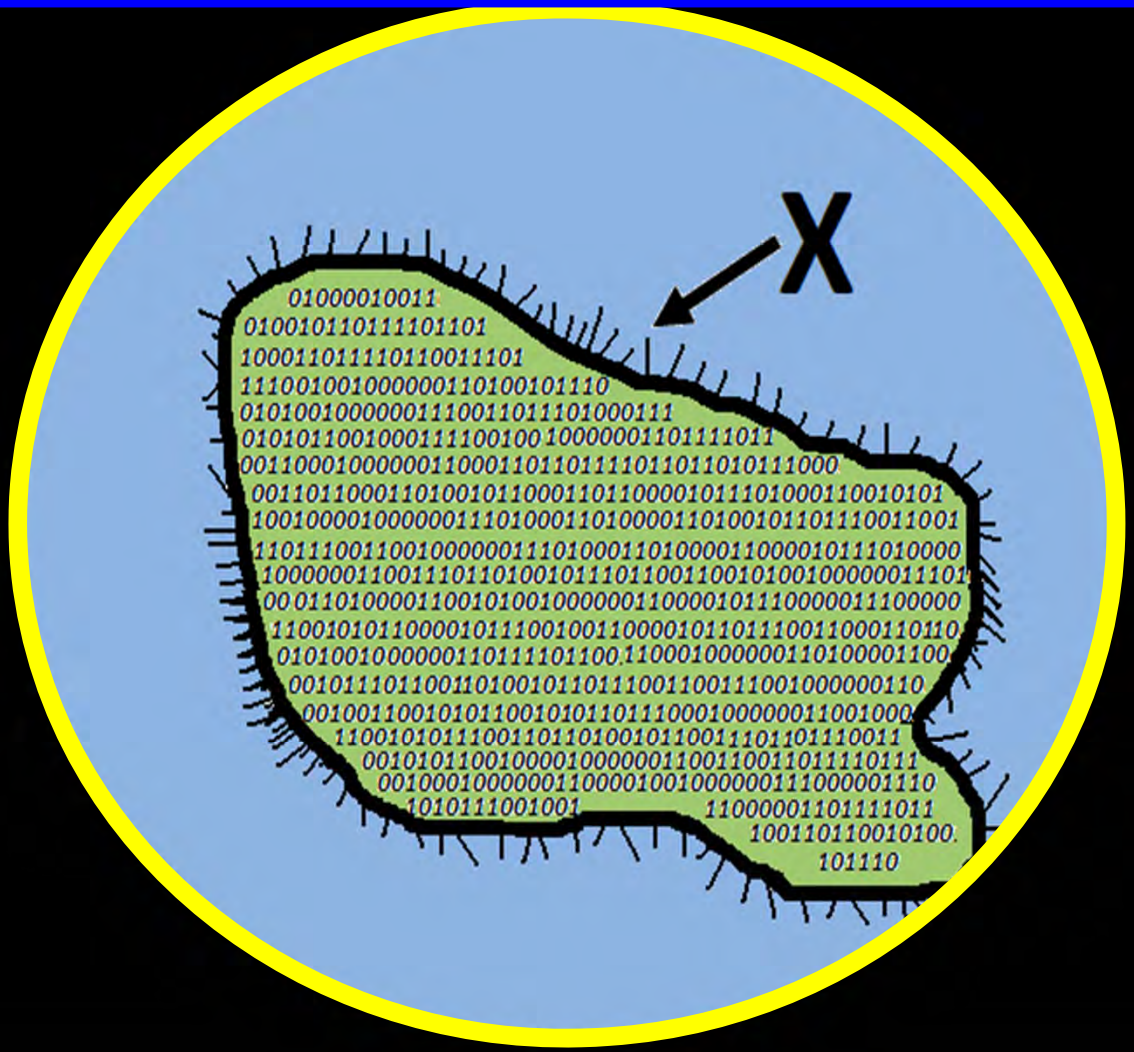

[5] COMPLEX AND SPECIFIED INFORMATION (CSI) AND THE DESIGN INFERENCE

[5] CSI AND THE DESIGN INFERENCE

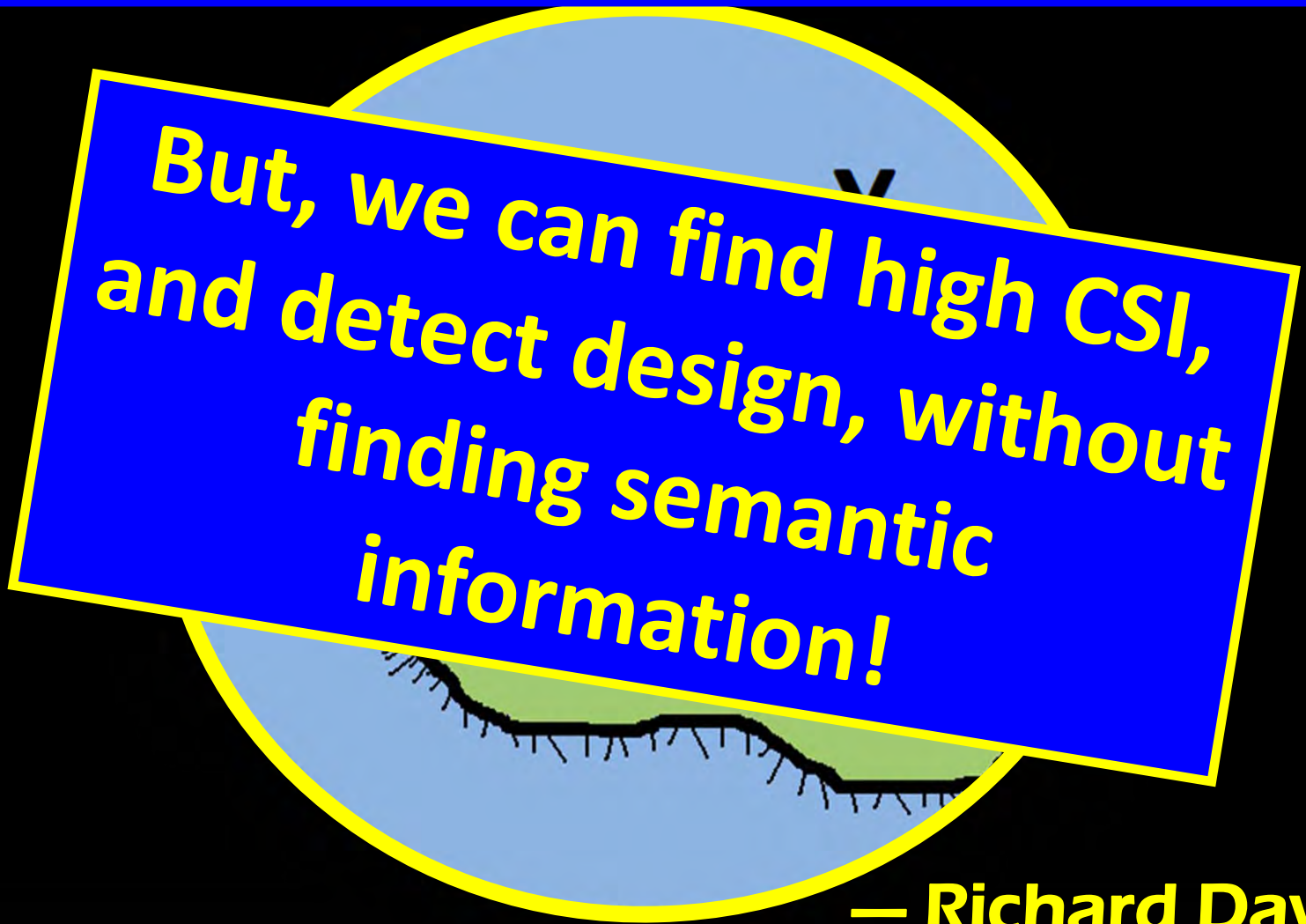
- Complexity: Related to unlikelihood
- Specified: A match to an independent pattern

Complex and Specified Information:

Information is “complex” if it is unlikely.

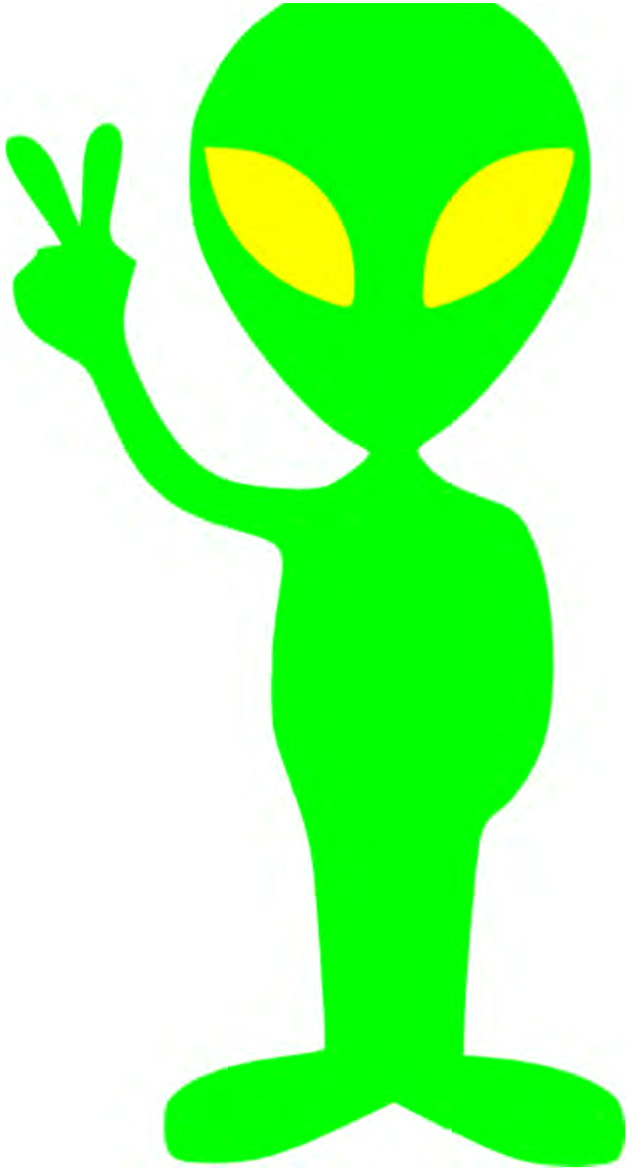


It's "specified" if it matches some independent pattern.

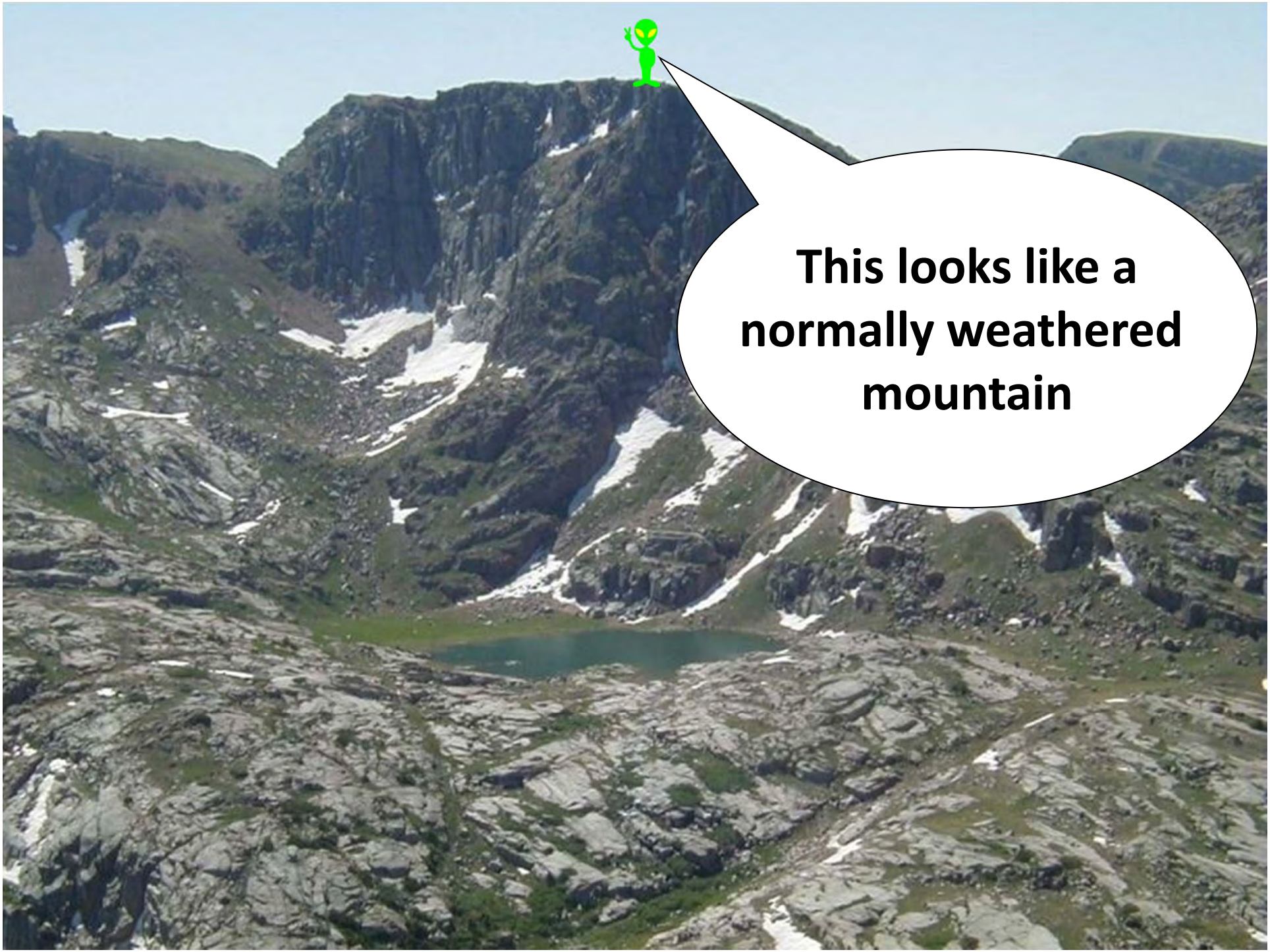


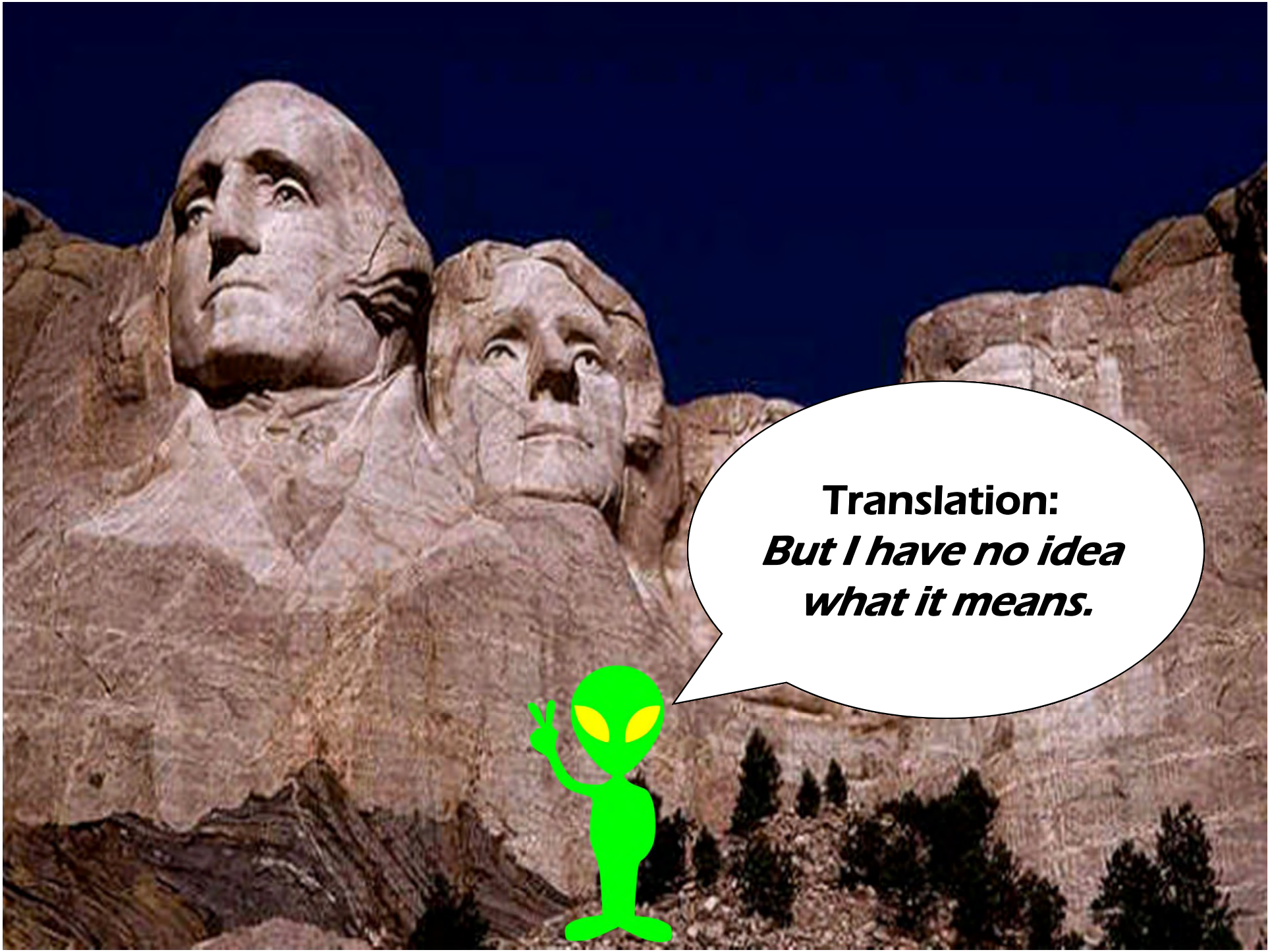
But, we can find high CSI, and detect design, without finding semantic information!

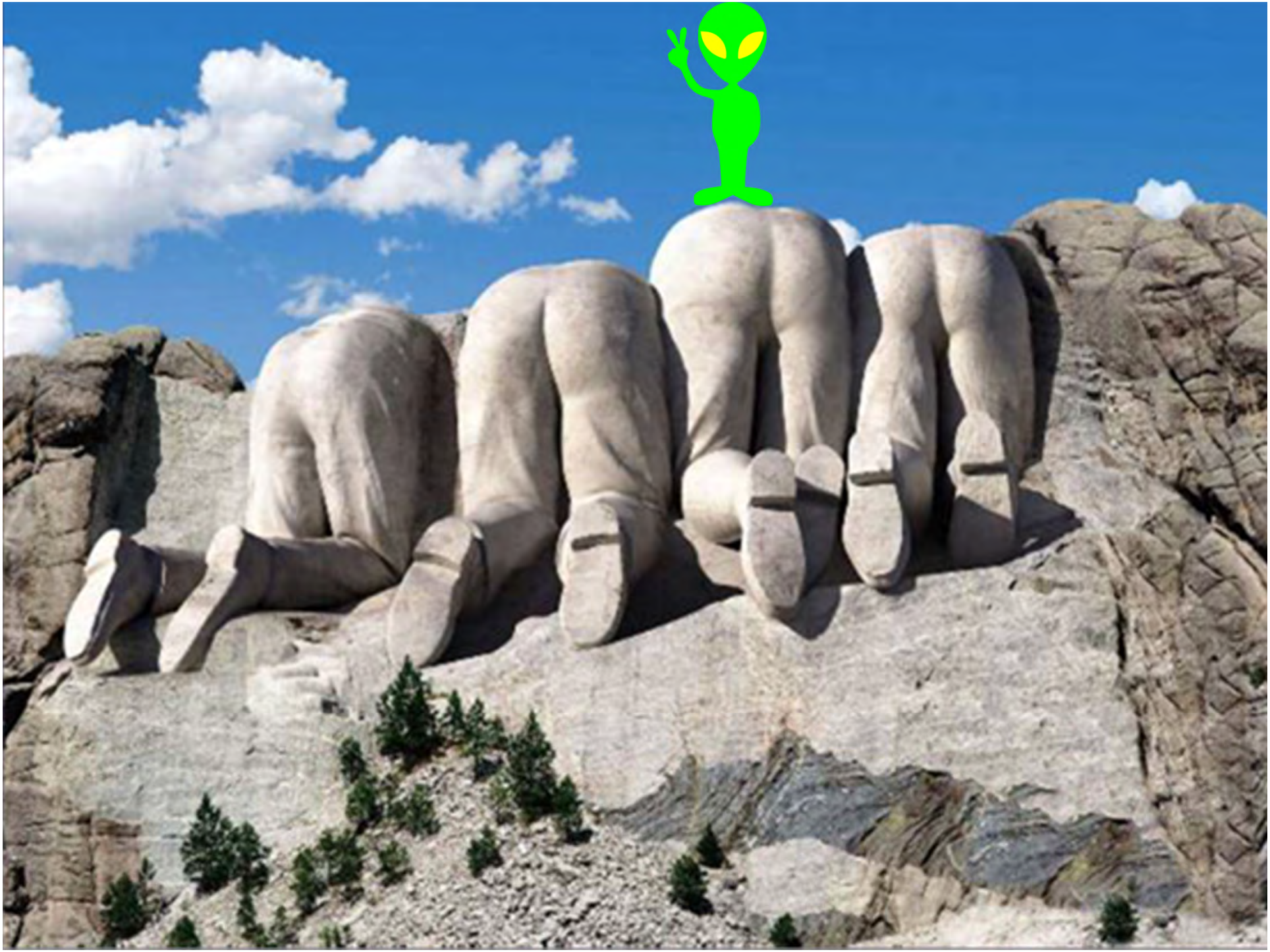
— Richard Dawkins

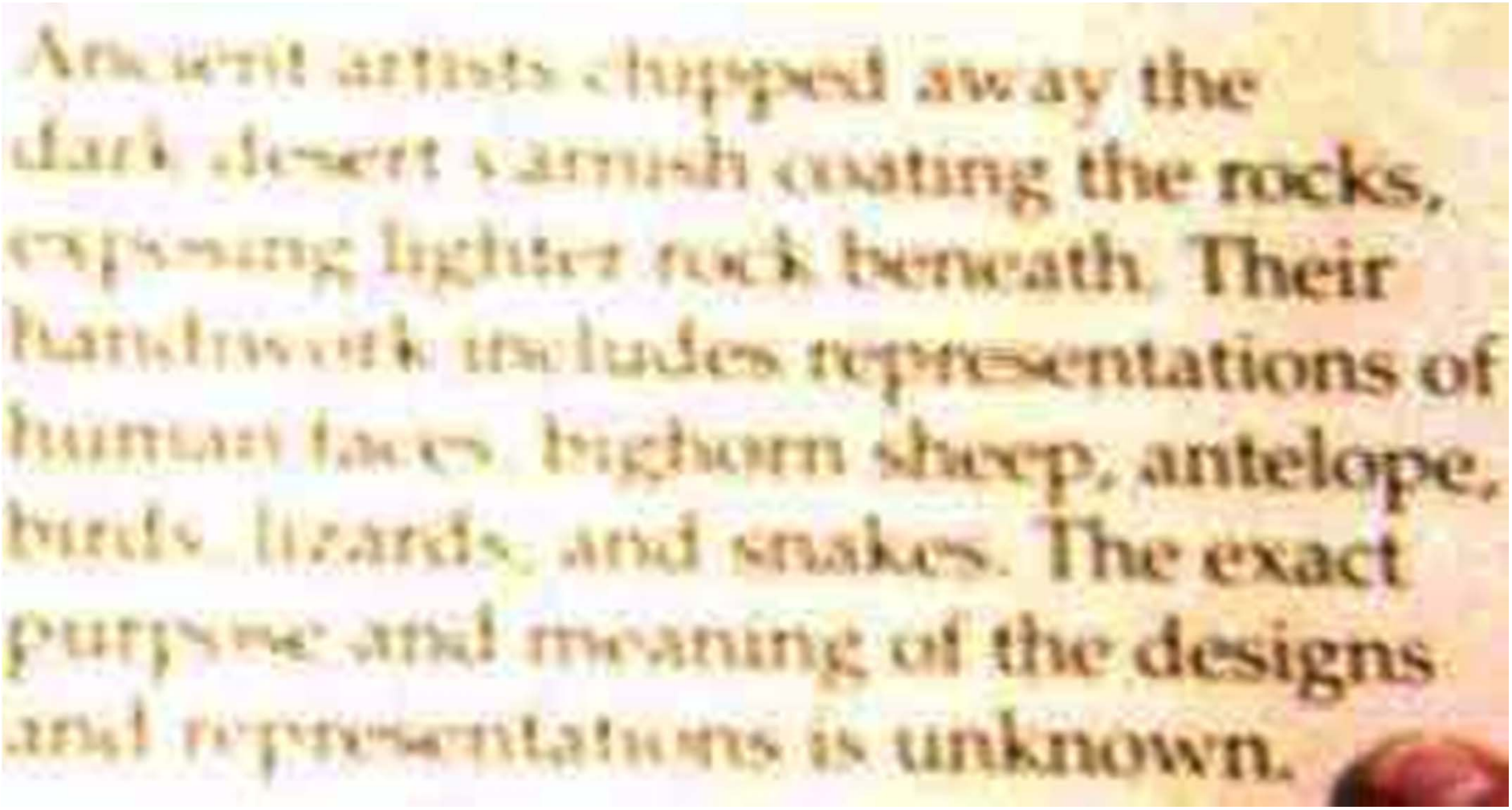


GORK


This looks like a normally weathered mountain

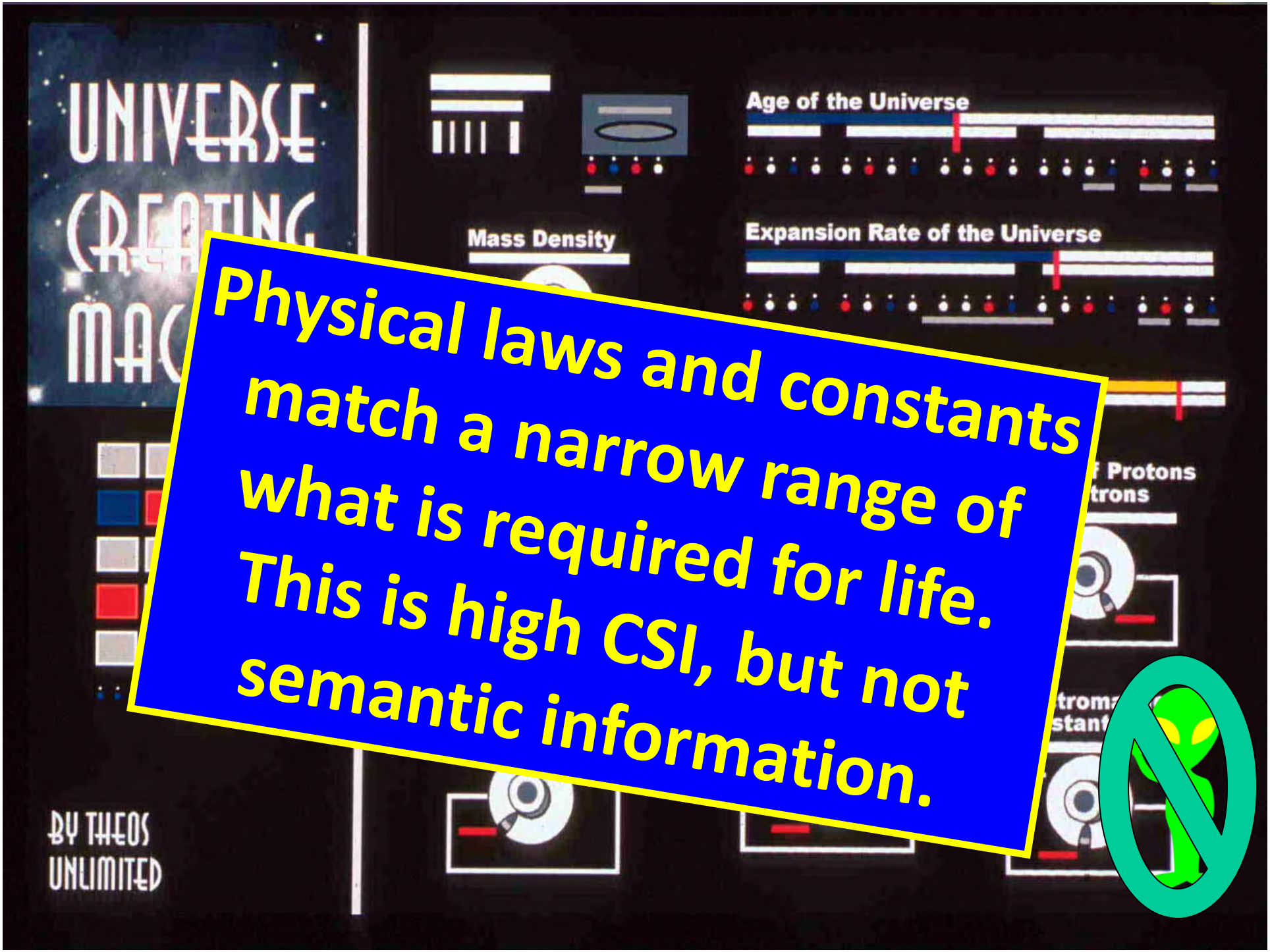

Translation:
But I have no idea
what it means.

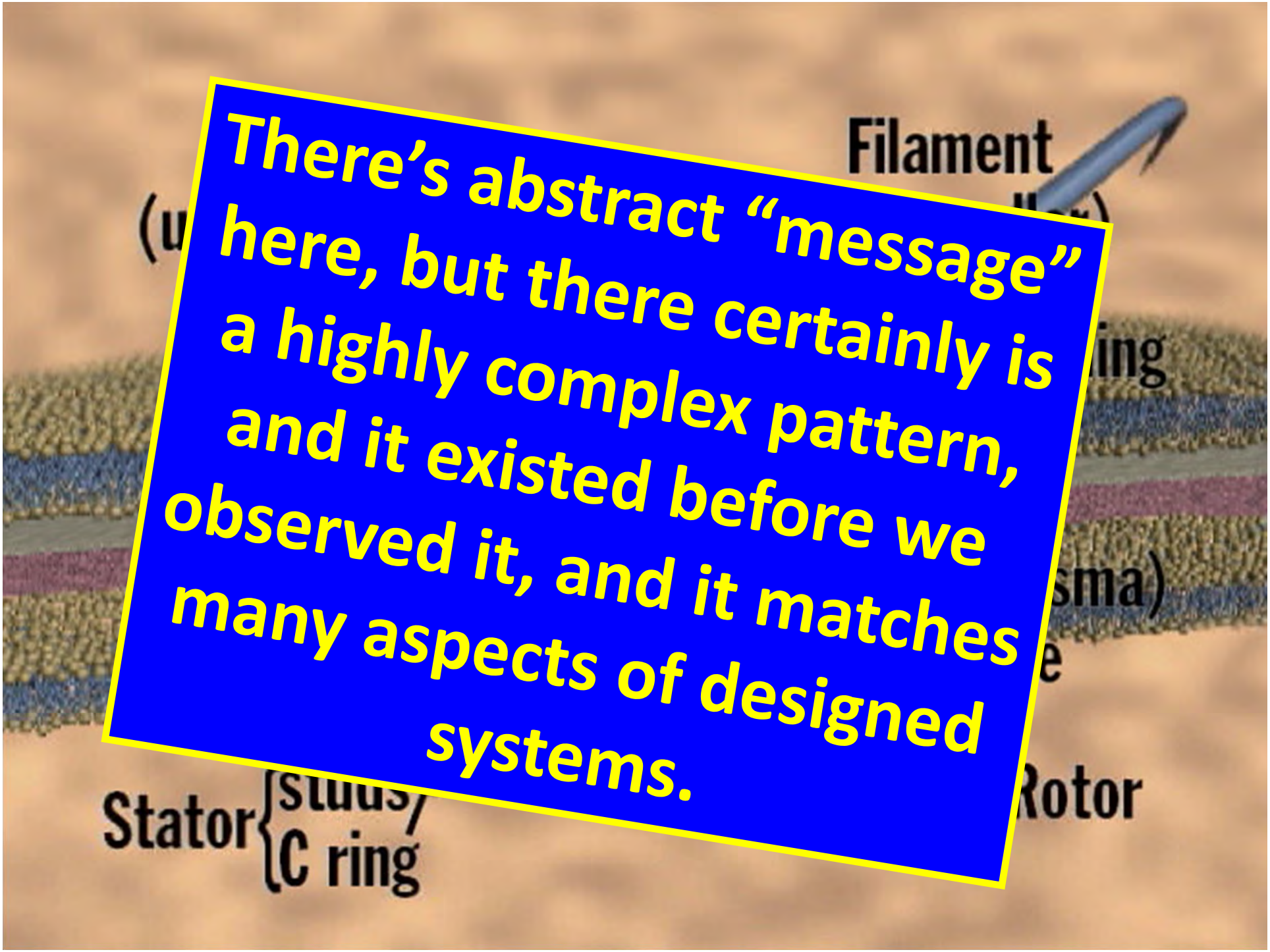




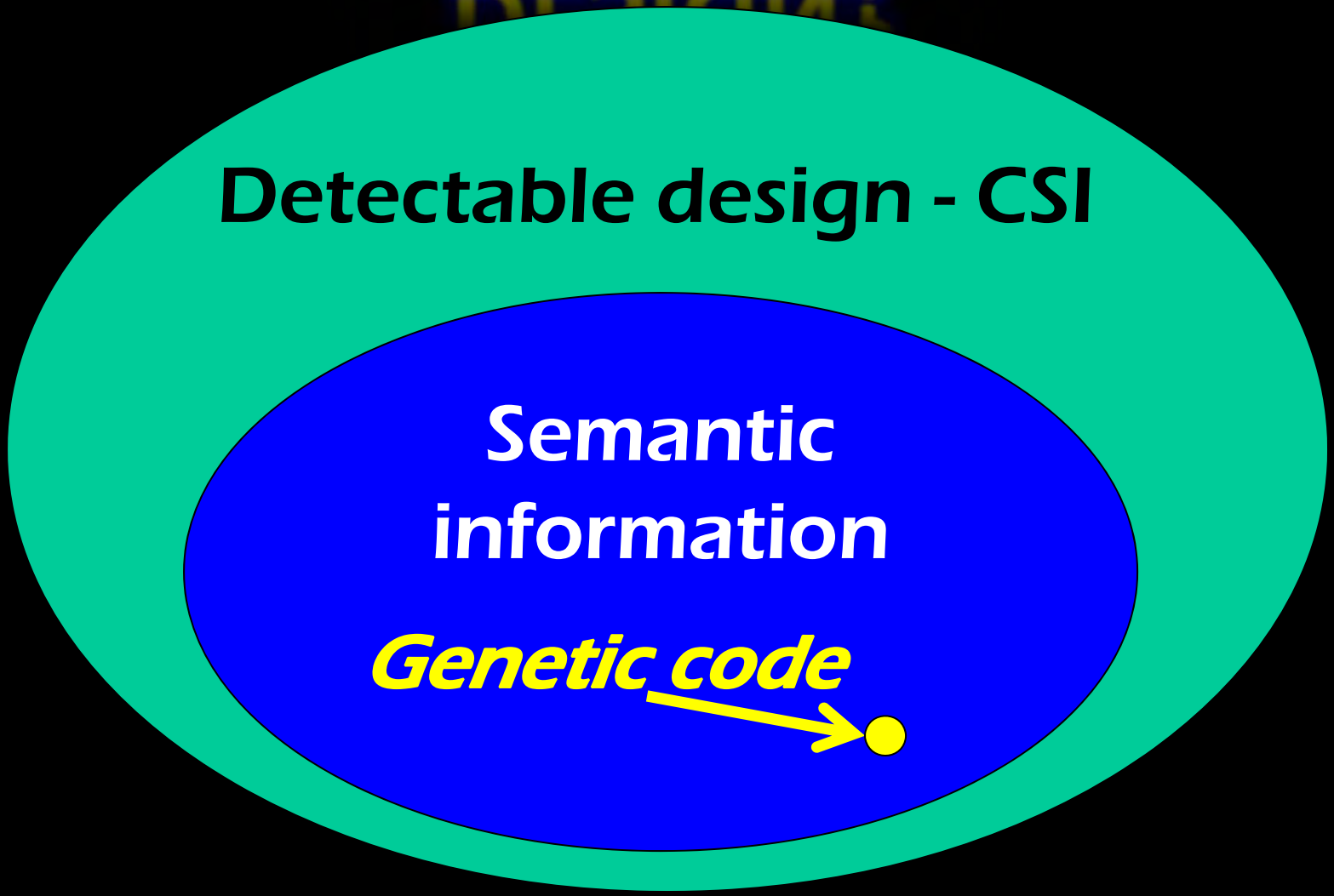
Smithsonian Exhibit: "The exact purpose and meaning of the designs and representations is


Search for
Extra-
Terrestrial
Intelligence
Translation:
Resistance
is futile


UNIVERSE
Age of the Universe
Mass Density
Expansion Rate of the Universe
Physical laws and constants match a narrow range of what is required for life. This is high CSI, but not semantic information.
BY THEOS UNLIMITED

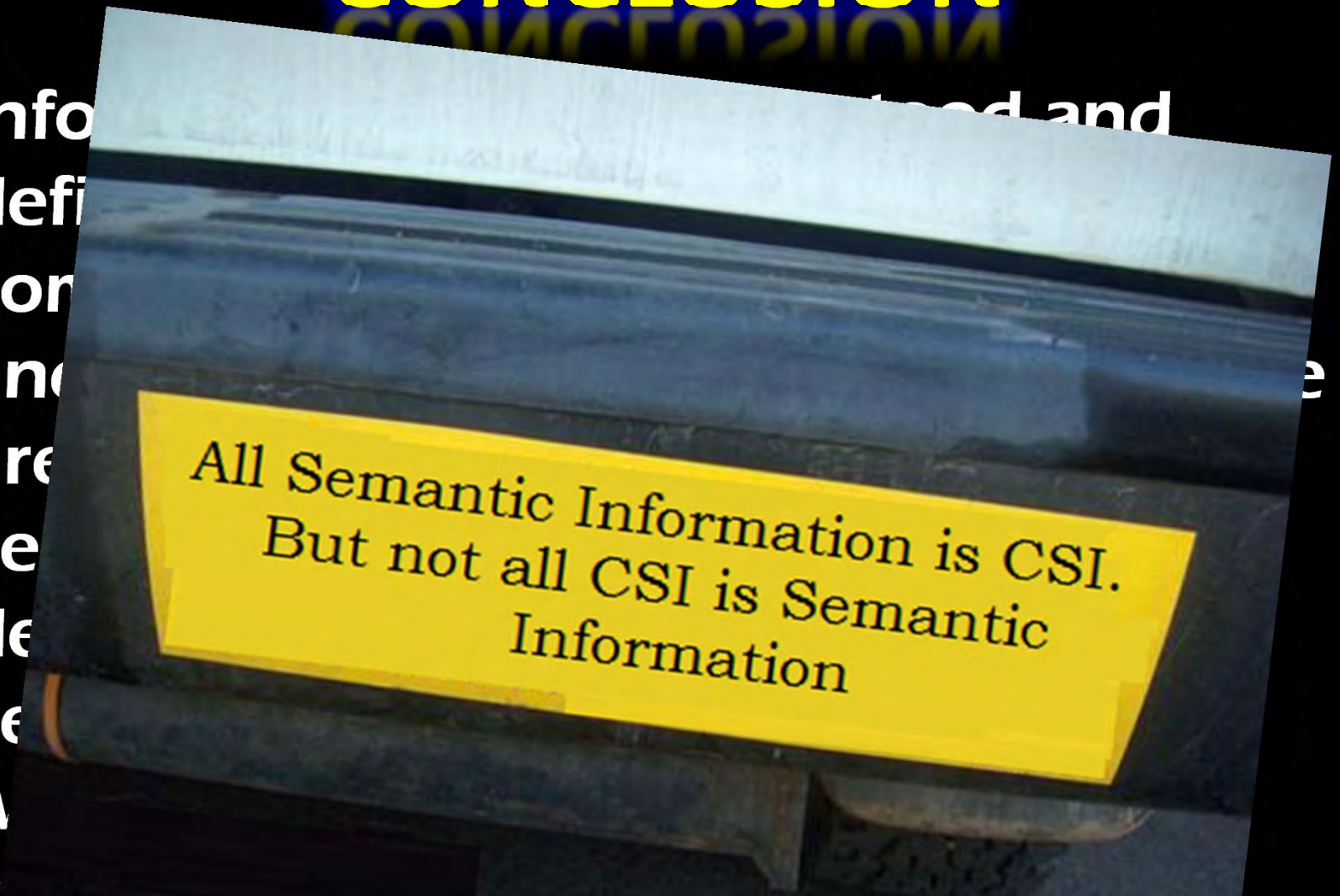

There's abstract "message" here, but there certainly is a highly complex pattern, and it existed before we observed it, and it matches many aspects of designed systems.
Filament
Stator
Rotor

WHAT HELPS US DETECT DESIGN?



CONCLUSION

- Info… …tood and defi…
- Son… and… …e are…
- Se… de…
- Se… w… In… mode of design…
- The Genetic Code is a form of Semantic…



Thank you!

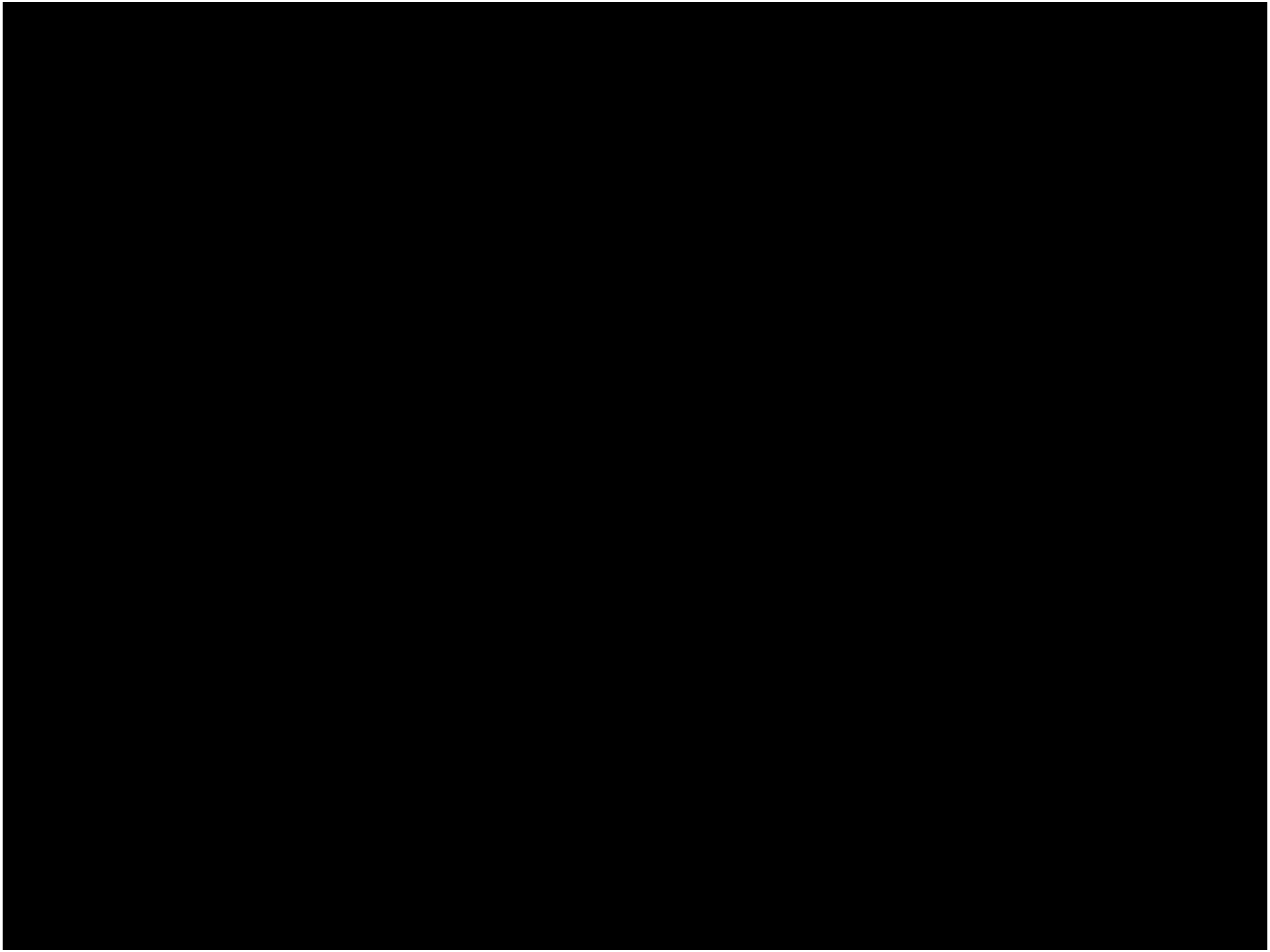
E-mail: cluskin@discovery.org

Discovery Institute: www.discovery.org

ID Portal: www.intelligentdesign.org

News Site: www.evolutionnews.org

Podcast: www.idthefuture.com



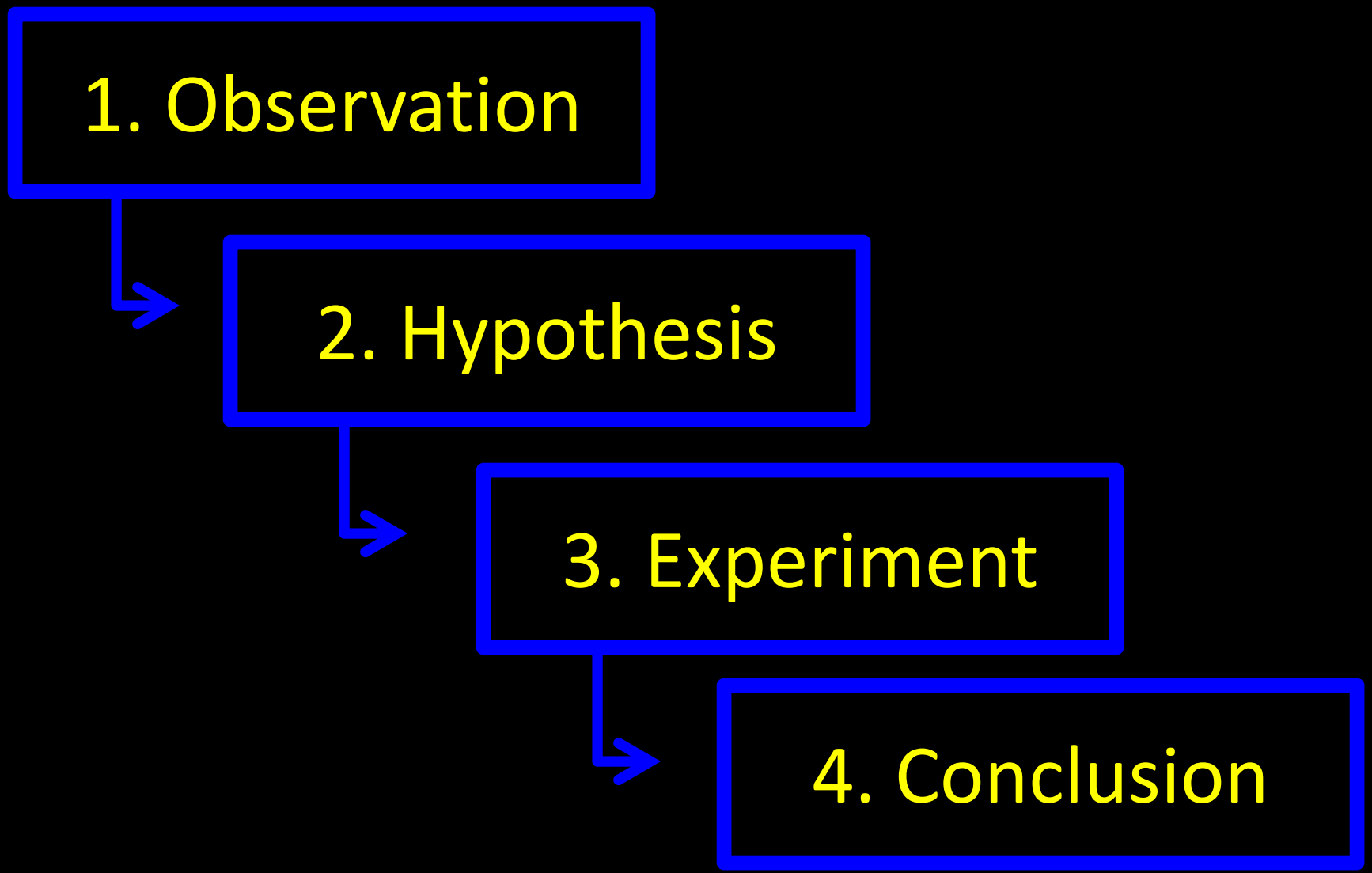
What's wrong with this statement?

Darwinian evolution faces the "restriction" that only changes which give you some functional advantage will tend to be preserved.

Some changes might be deleterious or lethal. Those stages won't survive.

Yes, neutral mutations can sometimes be fixed, but this is a game of pure chance. As my colleague Anne Gauger will discuss, there's a limit to how many neutral mutations can be fixed based upon known probabilistic resources available over Earth's history.

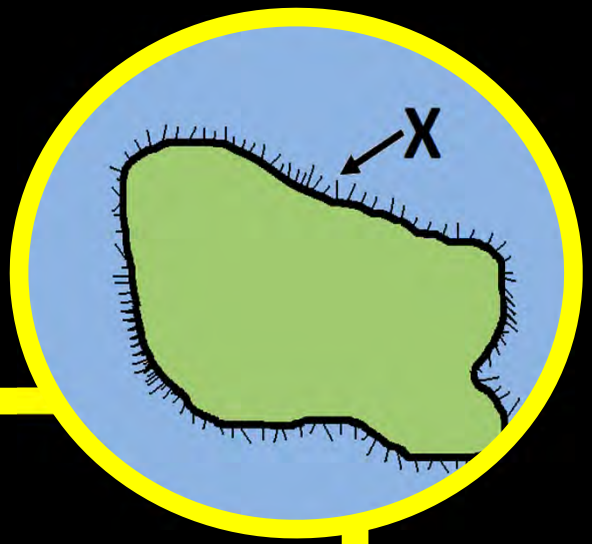
The Scientific Method is commonly described as a 4-step process:



1. Observation

ID begins with the observation that intelligent agents produce high levels of complex and specified information (CSI).

2. Hypothesis



Design theorists hypothesize that if a natural object (such as "X," above) was designed, it will contain high levels of CSI.

3. Experiment

ID theorists then perform experimental tests upon natural objects to determine if they contain high CSI. Examples include genetic knockout tests, mutational sensitivity tests, and theoretical computer simulations.

Mutational Sensitivity Tests

150 sites with 20 amino acids = 150^{20}

possible combinations

Just how complex and specified must a protein be?

Douglas Axe

3 Critical Questions?

How common (or rare) are functional sequences (i.e. proteins) among all the possible combinations of amino acids?

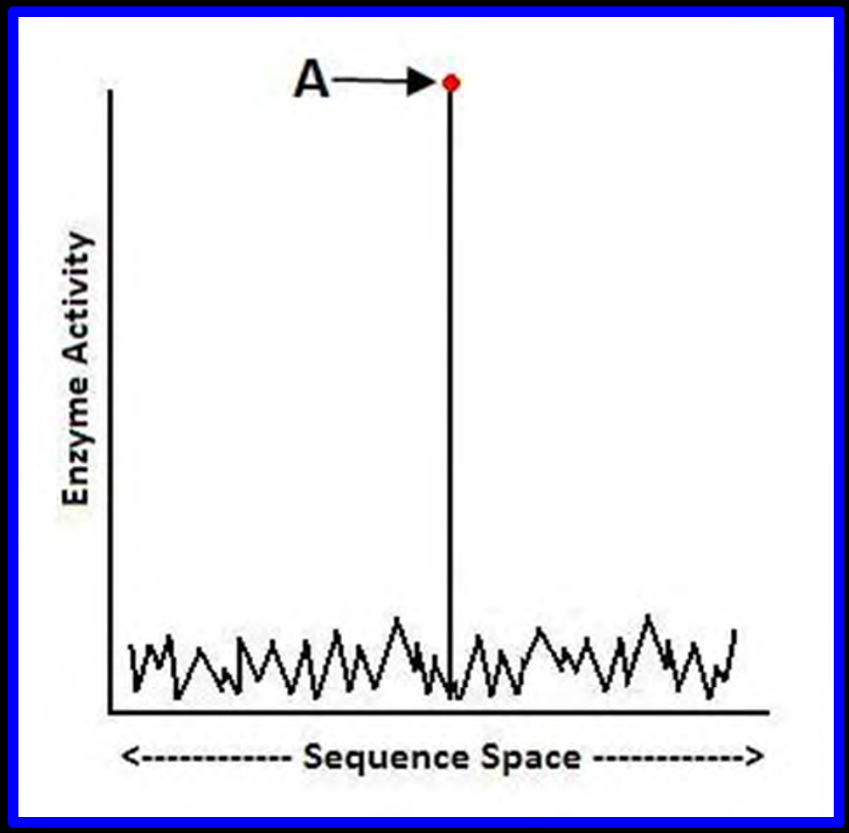
Does Darwinian evolution encounter the combinatorial inflation problem when generating new proteins?

Are proteins multi-mutation features?

Combinatorial Inflation Problem in Protein Sequences

Many amino acids must be "just right" to yield a functional protein fold.

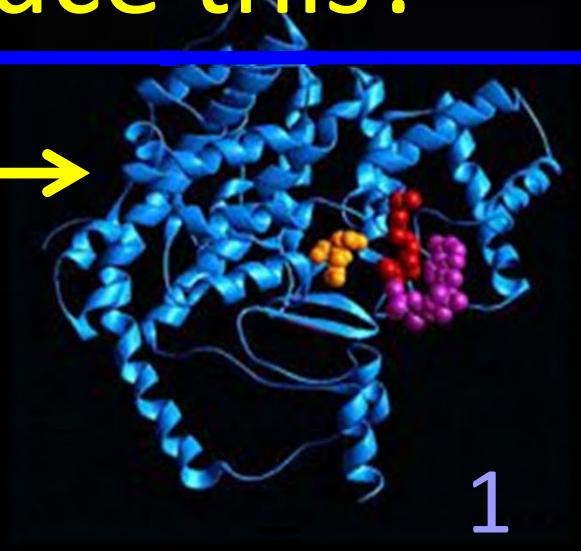
Chance of a random sequence of getting stable, functional protein fold = $1/10^{74}$



(Se "Estimating the Prevalence of Protein Sequences Adopting Fu Biology, Vol. 341: 1295-1315 (2004); Douglas A. Axe, "Extreme Fu Changes on Enzyme Exteriors," *Journal of Molecular Biology*, Vol.

Are there sufficient probabilistic resources to produce this?

For every ONE of these

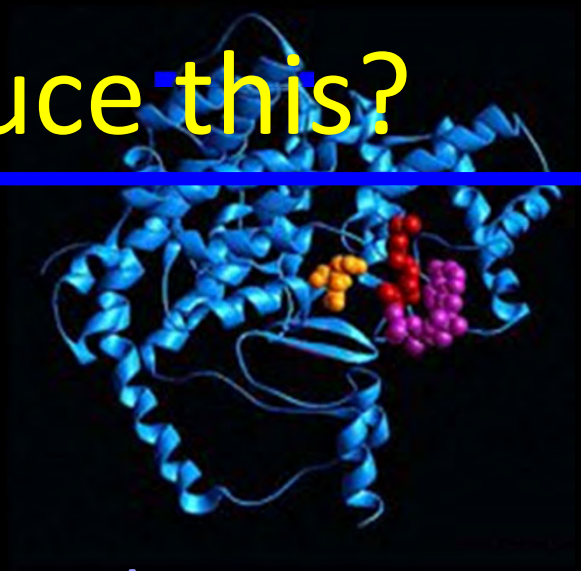


How many of these?

1

????

Are there sufficient probabilistic resources to produce this?



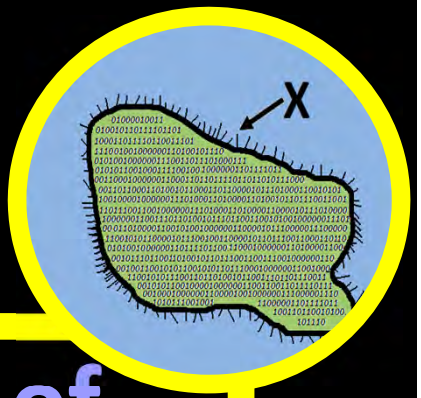
$$\frac{\text{Functional folds of a given length}}{\text{Number of sequences of a given length that yield a functional fold}} = \frac{1}{10^{74}}$$

Not Enough Trials to Search the Space of Possibilities

$$\frac{\text{Number of Trials or Organisms in the History of Life}}{\text{Number of Sequences of to be Searched}} = \frac{10^{40}}{10^{74}}$$

Conclusions: There are Insufficient Probabilistic Resources Across Earth's Entire History to Produce the Complex and Specified Information We Observe in Proteins.

4. Conclusion



Because X exhibits high levels of CSI, a quality known to be produced only by intelligent design we conclude that X was intelligently designed.

ID USES THE SCIENTIFIC METHOD:

1. Observation: Intelligence is the Cause of High CSI.

2. Hypothesis (Prediction): Life Will Contain High Levels of Complex and Specified Information.

3. Experiment: Empirical Research Uncovers Astronomical CSI in Biological Systems.

4. Conclusion: Many high CSI aspects of life were designed.