

The Scientific World View

- **The universe is understandable.**
- **Scientific ideas may change.**
- **Scientific knowledge is durable.**
- **Science cannot provide complete answers to all questions.**

Scientific Inquiry

- **Science demands evidence.**
- **Science is a blend of logic and imagination. It is creative.**
- **Science explains and predicts.**
- **Scientists try to identify and avoid bias.**
- **Science is not authoritarian.**
- ***Science is fun!!***

Scientific Enterprise

- **Science is a complex social activity.**
- **Science is organized into content disciplines and is conducted in various institutions.**
- **Scientists participate in public affairs both as specialists and as citizens.**
- **There are generally accepted ethical principles in the conduct of science.**

Thinking Science

1. Thinking critically
2. Evidential reasoning
3. Judging authority

How Do Scientists Work?

1. Description

2. Single Hypothesis

**3. Multiple Working
Hypotheses**

Description

- **Describes what is observed**
- **Provides necessary data**
- **Does not provide explanation**

Single Hypothesis

- **Provides one testable hypothesis**
- **Scientist devotes much energy and creativity to “proving” or supporting her/his idea**
- **Other hypotheses may equally or better explain the phenomenon.**
- **Scientist may be blinded to these other hypotheses.**

Multiple Working Hypotheses

- **Several worked nearly simultaneously.**
- **Provides many possible hypotheses for testing with the available data.**
- **Many ideas are tested with the same or little additional effort.**
- **All data can be accounted for.**
- **New hypotheses can be generated as they develop.**
- **Scientist has no favorite idea, hence is less biased.**

Science

- **Social Activity of hundreds of thousands of people over hundreds of years.**
- **Scientific knowledge base is huge. No one can know it all. Some too technical.**
- **Controversy is natural in science.**

Nothing is “Proved” in Science

- **Science tests hypotheses to see if they fail.**
- **The one(s) that are best supported and not falsified are tentatively accepted.**
- **Hypotheses with best predictions are best hypotheses.**
- **To apply policy, medicine & other work, order hypotheses by level of support and predictions.**

**All in science is worthless
unless they are
communicated effectively
to other scientists to test and
further develop.**

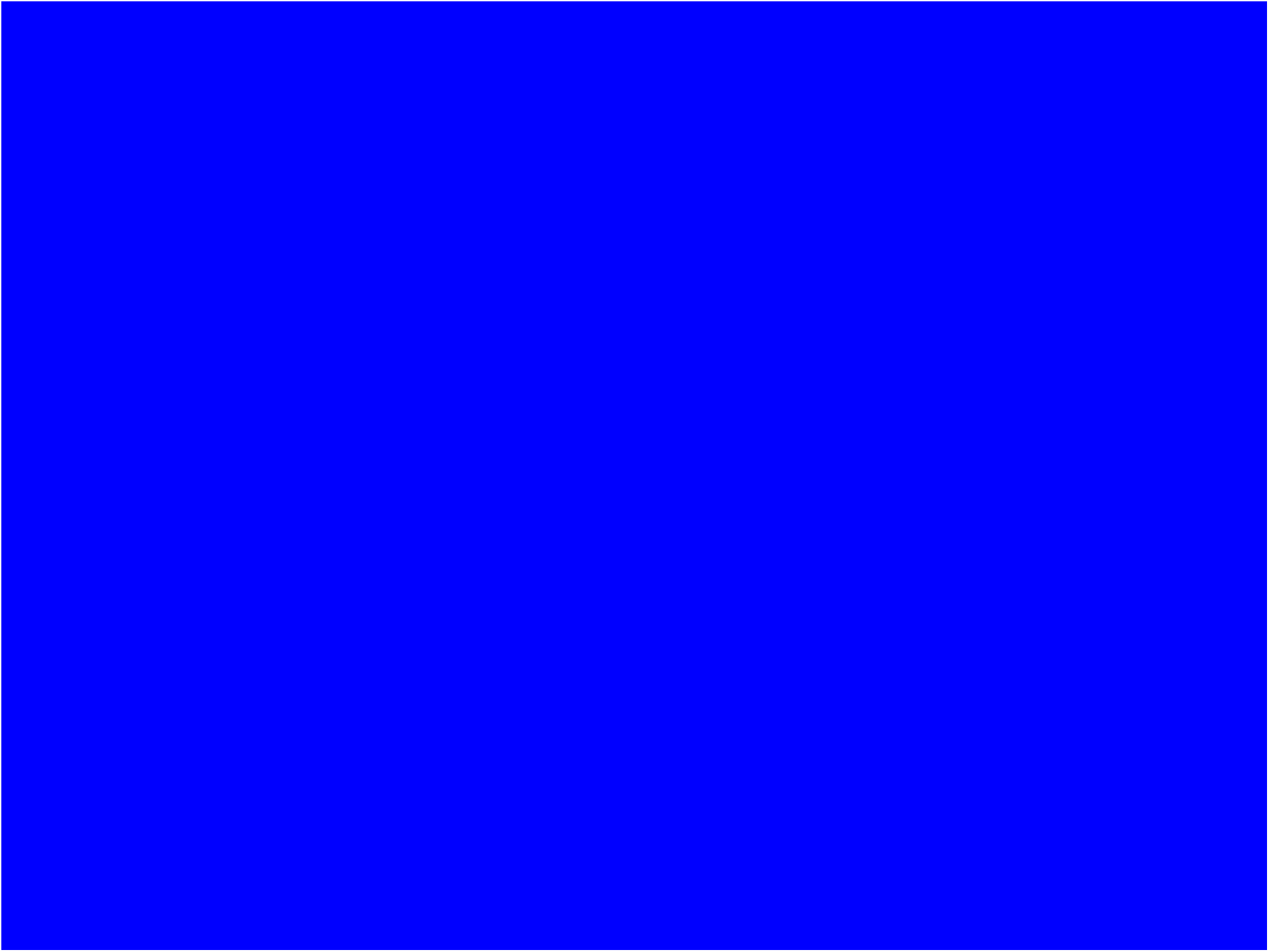
*Communication is
the most important
part of science.*

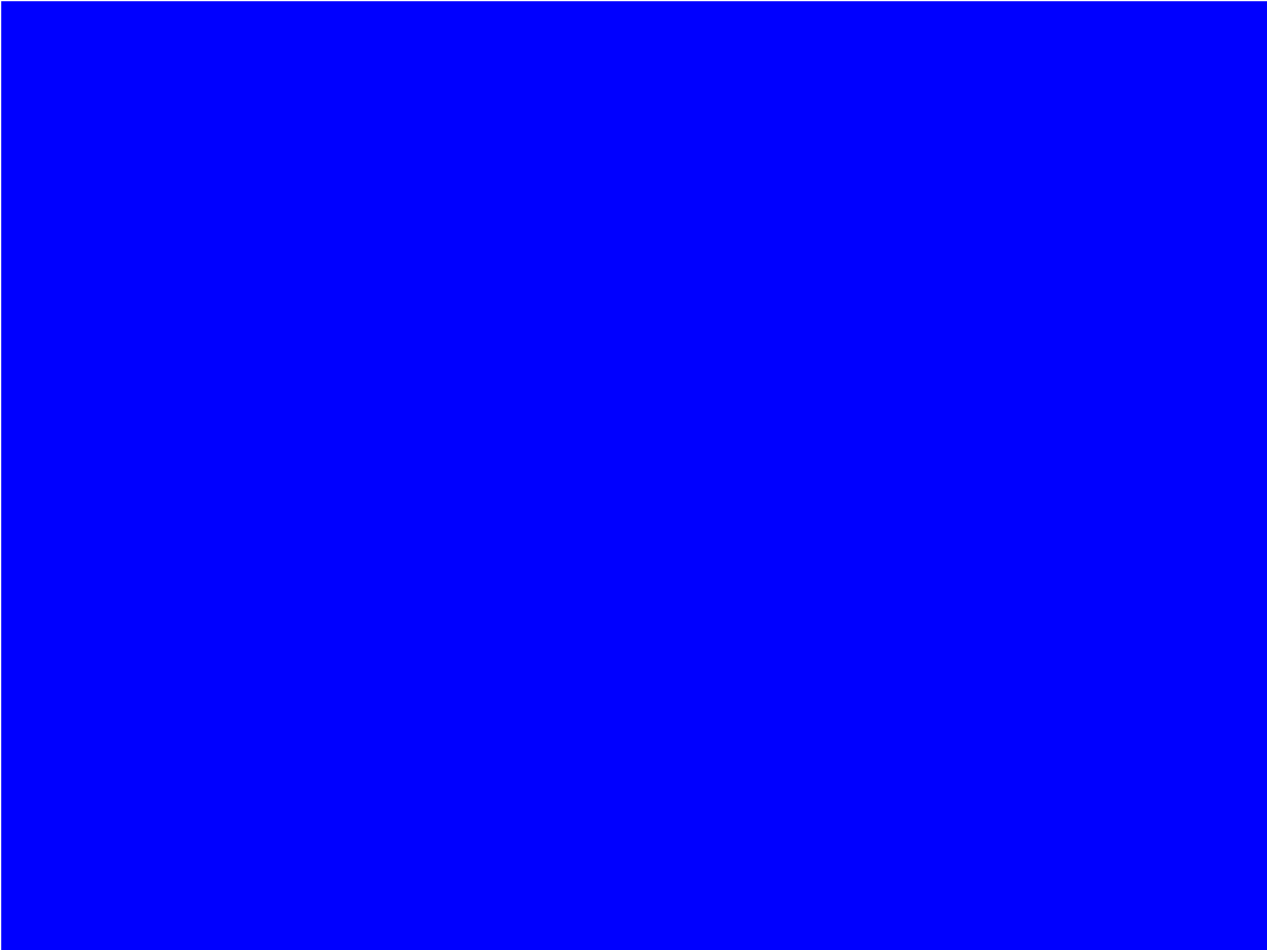
Scientific Communication

- *Publication*
 - Peer-Reviewed Journals
 - Electronic Publication
 - Other
- *Internet*
 - Email communication
 - Bulletin Boards
- *Presentations at Meetings*
 - Posters
 - Talks
 - Slides

Publication Process

- **Submit manuscript, 1 original, 2 copies & electronic disks of everything.**
- **Ms sent to two reviewers.**
- **Reviews sent to author for revision.**
- **Resubmitted.**
- **Accepted.**
- **Copy edited.**
- **Printed (or posted to the web)**





Posters

- **Keep them simple.**
- **Use clear pictures & graphs**
- **Not a “paper on the wall”**
- **Promote discussion**

Slides

- **Simple**
- **Few words**
- **Large letters**
- **Correct colors**
- **Big & simple pictures & graphs**
- **Fill in the details in your talk**



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What is Life?

1) ?

2) ?

3) ?

4) ?

5) ?

6) ?

7) ?

8) ?

What is Life?

- 1. Metabolizes.**
- 2. Groups to form “bodies” to gather energy.**
- 3. Reproduces.**
- 4. Properties transferable from one generation to another.**
- 5. Uses an external environment.**
- 6. Evolves.**