

On Discoveries, Problems, and Solutions



All truths are easy to understand once they are discovered; the point is to discover them.
—Galileo Galilei, 1632

The more original a discovery, the more obvious it seems afterwards.
—Arthur Koestler, 1970

The problem is not so much to see what nobody has yet seen, as to think what nobody has yet thought.
—Arthur Schopenhauer, 1851¹

It isn't that they can't see the solution. It is that they can't see the problem.
—G. K. Chesterton, 1935

To see what is in front of one's nose needs a constant struggle.
—George Orwell, 1946

There is no regular procedure, no logical system of discovery, no simple, continuous development.
—Gerald Holton, 1973

There are many rules for choosing good solutions, but there are no rules for selecting good rules.
—Anonymous

It requires a very unusual mind to undertake the analysis of the obvious.
—Alfred North Whitehead, 1925

Talent hits a target no one else can hit; genius hits a target no one else can see.
—Arthur Schopenhauer, 1844

¹Frequently misattributed to Albert Szent-Györgyi, who just quoted it in 1957.

In every work of genius we recognize our own rejected thoughts; they come back to us with a certain alienated majesty.

—*Ralph Waldo Emerson*, 1841

From an individual exceptional man alone is any great addition to be expected to a sum of original conceptions. Who could imagine Faraday as cooperating!?

—*Theodore William Richards*, 1902

One of the greatest pains to human nature is the pain of a new idea.

—*Walter Bagehot*, 1884

The human likes a strange idea as little as the body likes a strange protein, and it resists it with a similar energy.

—*Wilfred Trotter*, 1941²

Don't worry about people stealing an idea. If it's original, you will have to ram it down their throats.

—*Howard H. Aiken*, 1987

We don't believe anything we don't want to believe.

—*Theodore Sturgeon*, 1953

It takes years to drive an idea through a quarter-inch of human skull.

—*Charles F. Kettering*, 1961

A new scientific truth does not triumph by convincing its opponents and making them see the light, but rather because its opponents eventually die, and a new generation grows up that is familiar with it.

—*Max Planck*, 1950³

Whenever a new and startling fact is brought to the light in science, people first say, 'it is not true', then 'it is contrary to religion', and lastly, 'everybody knew that before'.

—*Louis Agassiz*⁴

An ingenious conjecture greatly shortens the road.

—*Gottfried Leibniz*, 1685

Intuition isn't the enemy, but the ally, of reason.

—*John Kord Lagemann*, 1955

²A later paraphrase of this quote by P. B. Medawar is even more popular.

³A popular shorter (anonymous?) paraphrase of this aphorism is: "Science advances one funeral at a time".

⁴As quoted in 1863 by Charles Lyell. This famous maxim, possibly based on an earlier (circa 1819) line by Arthur Schopenhauer, was paraphrased later by William James (in 1907), W. I. B. Beveridge (in 1955), J. B. S. Haldane (in 1963), Arthur C. Clarke (in 1968), Dorothy Maud Wrinch, and probably many others.

Every great advance in science had issued from a new audacity of imagination.

—*John Dewey*, 1929

The scientist, if he is to be more than a plodding gatherer of bits of information, needs to exercise an active imagination.

—*Linus Pauling*, 1943

Imagination comes first in both artistic and scientific creations, but in science there is only one answer and that has to be correct.

—*James Watson*, 1987

Every now and then, a man's mind is stretched by a new idea or sensation, and never shrinks to its former dimensions.

—*Oliver Wendell Holmes Sr.*, 1858

Lack of money is no obstacle. Lack of an idea is an obstacle.

—*Ken Hakuta*, 1988

Be less curious about people and more curious about ideas.

—*Marie Curie*⁵

If you want to have good ideas you must have many ideas. Most of them will be wrong, and what you have to learn is which ones to throw away.

—*Linus Pauling*, 1995

There are well-dressed foolish ideas - just as there are well-dressed fools.

—*Nicolas Chamfort*⁶

For an idea ever to be fashionable is ominous, since it must afterwards be always old-fashioned.

—*George Santayana*, 1913

Whenever sleep seized me I would see those very problems in my dreams; and many questions became clear to me in my sleep.

—*Avicenna*⁷

No one has ever had an idea in a dress suit.

—*Frederick Banting*, 1922

Beware of all enterprises that require new clothes.

—*Henry David Thoreau*, 1854

Be regular and orderly in your life [...], so that you may be violent and original in your work.

—*Gustave Flaubert*, 1876

⁵As quoted, without a date, by E. Curie Labouisse in 1937.

⁶As quoted, without a date, by William G. Hutchinson in 1902.

⁷As quoted, without a date, by W. E. Goldman in 1974.

Do not fear to be eccentric in opinion, for every opinion now accepted was once eccentric.

—*Bertrand Russell*, 1951

I'll be more enthusiastic about encouraging thinking outside the box when there's evidence of any thinking going on inside it.

—*Terry Pratchett*, 2016

A beautiful idea has a much greater chance of being correct than a ugly one.

—*Roger Penrose*, 1989

If nature were not beautiful it would not be worth knowing, and [then] life would not be worth living.

—*Henri Poincaré*, 1908

Nature is never so admired as when she is understood.

—*Bernard Le Bovier de Fontenelle*, 1733

There are men who never err, because they never propose anything rational.

—*Johann Wolfgang von Goethe*, 1832

The man who makes no mistakes does not usually make anything.⁸

—*E. J. Phelps*, 1889

You must never feel badly about making mistakes [...] as long as you take the trouble to learn from them.⁹

—*Norton Juster*, 1961

An error doesn't become a mistake until you refuse to correct it.

—*O. A. Battista*, 1946

Who excuses himself, accuses himself.

—*European proverb*¹⁰

Man is condemned to exhaust all possible errors when he examines any set of facts before he recognizes the truth.

—*Jean-Baptiste Lamarck*, 1809

⁸In his full text, Phelps explicitly refers to an earlier (circa 1868) maxim by Archbishop William Connor Magee. Later paraphrases by Joseph Conrad, Theodore Roosevelt, and Marva Collins are also frequently quoted.

⁹See also the second quote in the *On the Wise...* section.

¹⁰Here and below, the label *European* is used for any proverb that is similar (within a reasonable flexibility of translation) in two or more European languages.

Research is the process of going up alleys to see if they are blind.

—*Marston Bates*, 1950

For men with insatiable curiosity, their prototype is [...] the dog sniffing tremendously at an infinite series of rat-holes.

—*H. L. Mencken*, 1923

It is a good morning exercise for a research scientist to discard a pet hypothesis every day before breakfast. It keeps him young.

—*Konrad Lorenz*, 1966

There is no failure except in no longer trying.

—*Elbert Hubbard*, 1895

You may be disappointed if you fail, but you are doomed if you don't try.

—*Beverly Sills*, 1997

Our greatest glory is not in never falling, but in rising every time we fall.

—*Confucius*, fifth century BC

Fall down seven times, get up eight.

—*Japanese proverb*¹¹

If you want to succeed, double your failure rate.

—*Thomas J. Watson*¹²

Only those who dare to fail greatly can ever achieve greatly.

—*Robert F. Kennedy*, 1966

Success teaches us nothing; only failure teaches.

—*Hyman G. Rickover*, 1954

Good judgment comes from experience. Experience comes from bad judgment.

—*Anonymous*¹³

He who risks nothing, can gain nothing.

—*Italian proverb*

He who does not risk, does not drink champagne.

—*Russian proverb*

To win without risk is to triumph without glory.

—*Pierre Corneille*, 1636

¹¹Here and below, proverbs are labeled by the languages in which they are common, rather than their countries of origin.

¹²As quoted, without a date, by Roger von Oech in 1982.

¹³I have seen this joke attributed to many authors, including Will Rogers, Rita Mae Brown, Randy Pausch, and even Mullah Nasreddin Hooja, but could not establish the actual original authorship.

He who knows how to endure everything can risk everything.

—*Luc de Clapiers*, 1746

All things are difficult before they are easy.

—*Thomas Fuller*, 1732

They can because they think they can.

—*Virgil*¹⁴

Where there is a will, there is a way.

—*European proverb*

Will is power.

—*French proverb*

Nothing great in the world has been accomplished without passion.

—*Georg Wilhelm Freidrich Hegel*, 1821

Expect problems and eat them for breakfast.

—*Alfred Armand Montapert*, 1970

We are continually faced with a series of great opportunities brilliantly disguised as insoluble problems.

—*John W. Gardner*, 1966

Men are generally idle and ready to satisfy themselves and intimidate the industry of others by calling that impossible which is only difficult.

—*Samuel Johnson*, 1787

So many things are possible just as long as you don't know they're impossible.

—*Norton Juster*, 1961

Things that are merely difficult never give lasting pleasure.

—*Voltaire*, 1759

Madam, if a thing is possible, consider it done; the impossible? that will be done.

—*Charles Alexandre de Calonne*, 1783

The greatest pleasure in life is doing what other people say you cannot do.

—*Walter Bagehot*, 1853

The only way of finding the limits of impossible is by going beyond them to the impossible.

—*Arthur C. Clarke*, 1972

Things are only impossible until they're not.

—*Hannah Louise Shearer*, 1988

¹⁴From his *Aeneid*, written in 29-19 BC.

It's kind of fun to do the impossible.

—*Walt Disney*¹⁵

The best way out is always through.

—*Robert Frost*, 1914

Where you cannot climb over, you must creep under.

—*Danish proverb*

Seek, and ye shall find.

—*The Bible* (Matthew 7:7)

To strive, to seek, to find, and not to yield.

—*Alfred Tennyson*, 1842

Where one door is shut, another opens.

—*Spanish proverb*

In the end, there is nothing too remote to be reached, or too well hidden to be discovered.

—*René Descartes*, 1637

We never stop investigating. [...] This has become the greatest survival trick of our species.

—*Desmond John Morris*, 1967

Patience is the greatest of all virtues.

—*European proverb*¹⁶

If I have ever done the public any service [...], 'tis due to nothing but industry and a patient thought.

—*Isaac Newton*, 1692

He that can have Patience, can have what he will.

—*Benjamin Franklin*, 1736

Genius is nothing else than a great aptitude for patience.

—*George-Louis Leclerc*, 1785

There is only one major sin: impatience.

—*Franz Kafka*, 1917

¹⁵As quoted, without a date, by Derek Walter in 1982.

¹⁶It is sometimes attributed to Cato, but I could not find a reliable contribution of his authorship.

Success in research needs four *G*s: *Glück, Geduld, Geschick, und Geld* (luck, patience, skill, and money).

—Paul Ehrenfest¹⁷

Let me tell you the secret that has led me to my goal. My strength lies solely in my tenacity.

—Louis Pasteur¹⁸

Toil conquered the world, unrelenting toil.

—Virgil¹⁹

No fine work can be done without concentration and self-sacrifice and toil and doubt.

—Max Beerbohm, 1914

The only factor becoming scarce in a world of abundance is human attention.

—Kevin Kelly, 1998

Dreams do come true, if we only wish hard enough. You can have anything in life if you will sacrifice everything else for it.

—J. M. Barrie, 1904

To gain that which is worth having, it may be necessary to lose everything else.

—Burnadette Devlin, 1969

We succeed only as we identify in life, or in war, or in anything else, a single overriding objective, and make all other considerations bend to that one objective.

—Dwight Eisenhower, 1957

Make no little plans; they have no magic to stir men's blood. [...] Make big plans, aim high in hope and work.

—Daniel Burnham, 1910²⁰

Too low they build, who build beneath the stars.

—Edward Young²¹

For a big ship, a long sailing.²²

—Russian proverb

¹⁷As quoted, without a date, by M. Perutz in 1988.

¹⁸As quoted, without a date, by Wayne W. Dyer in 2001.

¹⁹From his *Aeneid*, written in 29-19 BC.

²⁰Reportedly, first put on paper by a Burnham's associate, some Willis Polk.

²¹From his *Night Thoughts*, written in 1742-1745.

²²The recent (anonymous?) mocking, "For a big ship, a big torpedo", also seems valid not only literally—see the *On Society*... section below.

Most people would succeed in small things if they were not troubled with great ambitions.

—*Henry Wadsworth Longfellow*, 1857

The human tendency to regard little things as important has produced very many great things.

—*Georg Christoph Lichtenberg*²³

If politics is the art of the possible, research is surely the art of the soluble.

—*P. B. Medawar*, 1964

Pick battles big enough to matter, small enough to win.

—*Jonathan Kozol*²⁴

I have little patience with scientists who take a board of wood, look for its thinnest part and drill a great number of holes where drilling is easy.

—*Albert Einstein*, 1949

'Tis Ambition enough to be employed as an Under-Laborer in clearing Ground a little, and removing some of the Rubbish that lies in the way to Knowledge.

—*John Locke*, 1690

The most likely way to reach a goal is to be aiming not at that goal itself but at some more ambitious goal beyond it.

—*Arnold J. Toynbee*²⁵

Simplicity is the peak of civilization.

—*Jessie Sampter*, 1927

Genius is the ability to reduce the complicated to the simple.

—*C. W. Ceram*, 1951

It's the Simple things that are really effective.

—*Theodore Sturgeon*, 1941

There is always a well-known solution to every human problem - neat, plausible, and wrong.

—*H. L. Mencken*, 1917

It was beautiful and simple, as all truly great swindles are.

—*O. Henry*, 1908

²³From his *Notebook G* (1779-1783).

²⁴As quoted, without a date, in several reputable collections, starting not later than 1981.

²⁵As quoted, without a date, by Edward Myers in 1955. Note that this maxim is sometimes misattributed to the author's uncle, Arnold Toynbee (1852-1883).

The shortest distance between two points is under construction.

—Anonymous²⁶

Seek simplicity, and distrust it.

—Alfred North Whitehead, 1919

I'm suspicious of anyone who has a strong opinion on a complicated issue.

—Scott Adams, 2007

Nothing is as simple as we hope it will be.

—Jim Horning²⁷

The Lord God is subtle, though not malicious.

—Albert Einstein, 1946

I have yet to see any problem, however complicated, which, when you looked at it in the right way did not become still more complicated.²⁸

—Poul Anderson, 1969

It's so much easier to suggest solutions when you don't know too much about the problem.

—Malcolm Forbes, 1978

- Not every problem has a good solution.
- Every solution has side effects.

—Dan Geer, 2007

If a problem has no solution, it may not be a problem, but a fact - not to be solved, but to be coped with over time.

—Shimon Peres, 2001

If a problem does not have a technical solution, it must not be a real problem. It is but an illusion [...], a figment born of some regressive cultural tendency.

—Theodore Roszak, 1969

There is nothing more permanent than a temporary solution.

—Russian proverb²⁹

Believe those who are seeking the truth. Doubt those who find it.

—André Gide, 1952

²⁶This popular joke is frequently attributed to either Leo Aikman or some Noelie Altito, but I was unable to confirm either of these authorships, and even to identify the latter person.

²⁷The (undated) title of one of his blogs.

²⁸The so-called *Anderson's Law*.

²⁹Adjusted (in 1980) by Milton Friedman to describe “temporary” government programs.

No human being is constituted to know the truth, the whole truth, and nothing but the truth; and even the best of men must be content with fragments, with partial glimpses, never the full fruition.

—William Osler, 1905

There are no whole truths; all truths are half-truths. It is trying to treat them as whole truths that plays the devil.³⁰

—Alfred North Whitehead, 1954

Chase after the truth like all hell and you'll free yourself, even though you never touch its coat-tails.

—Clarence Darrow, 1938

A problem well stated is a problem half solved.

—Charles F. Kettering³¹

Well begun is half done.

—European proverb

Lead, follow, or get out of the way.

—Anonymous³²

You're either part of the solution or you're part of the problem.

—Anonymous³³

If you're not part of the solution, you're part of the precipitate.

—Henry J. Tillman³⁴

³⁰This is apparently a play around a much older line by François Rabelais: “Speak the truth and shame the devil”.

³¹As quoted in several reliable sources, starting not later than 1954.

³²This popular slogan (with slight variations) has been attributed to perhaps the record number of candidate authors, including Thomas Paine, Thomas Edison, George S. Patton, Ted Turner, Lee Iacocca, Laurence J. Peter, and Arthur Uther Pendragon. I was unable to establish the original author.

³³This line and its close siblings, quoted in several newspapers in the 1950s and the 1960s as unauthored jokes, are actually succinct paraphrases of an earlier (circa 1937) maxim by John R. Alltucker. The line became famous after it had been used by Eldridge Cleaver in his 1968 speech.

³⁴As quoted, without a date, by Robert A. Day and Nancy Sakaduski in 2011. Unfortunately I was unable to identify this author.