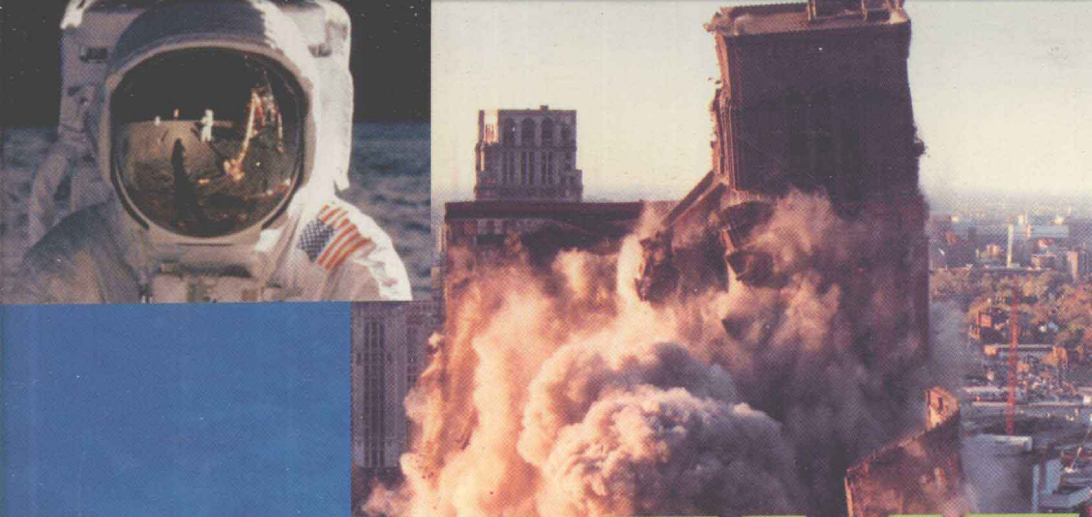

EXTREME SCIENCE

SCIENCE IN THE DANGER ZONE!

LARRY VERSTRAETE

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EXTREME SCIENCE

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For those brave and bold,
who extend the boundaries of our understanding

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Isaac Newton, the famous English scientist, is often credited with saying: "If I have seen further, it is by standing on the shoulders of giants." Certainly this is true for scientists and inventors who constantly build on the work of others. It is also true for writers like myself who rely on eyewitness accounts and scientific reports to tell stories of scientists' adventures. I am indebted to these "giants" not only for their faithfulness to detail and accuracy, but also to their courage and ingenuity in the face of overwhelming odds.

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AIBO	Mylar	Vaseline
AvaLung	Snare-Net	
Dillo-Cam	SoloTrek XVF	

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Introduction

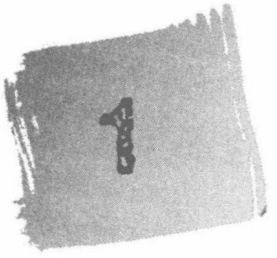
Don't be afraid of opposition. Remember, a kite rises against — not with — the wind.

Hamilton Mabie

In 1942 a three-man suicide squad sat atop a pile of radioactive uranium, ready to take drastic measures in case the experiment — the world's first nuclear chain reaction — went horribly wrong. The three physicists were ready to put their lives on the line to advance the frontiers of science.

Almost four hundred years earlier, Italian astronomer Giordano Bruno had faced another kind of ordeal. Bruno lived just before the turn of the seventeenth century, a dangerous time for anyone with new ideas. Those who held different views were often branded as heretics, teachers of falsehood. The punishment for being a heretic was severe: sometimes imprisonment, often death. So when Bruno wrote a book that suggested life might exist on other planets besides earth — a shocking concept to many — he was taking an enormous risk. He was arrested, tried and found guilty of heresy. Giordano Bruno was burned at the stake on February 17, 1600.

Science has its own special brand of heroes — people like the three men on top of the nuclear reactor, armed with little more than faith in their own logic — brave people like Bruno who challenge established ways. To do the job that science demands, scientists and inventors sometimes assume risks, take unusual steps, and attempt the bold and impossible. They go to extremes for the sake of discovery.



EXtreme EXperiments

Unravelling the truth . . .
providing proof

The important thing is not to stop questioning.

Albert Einstein

Most experiments are carefully planned events designed to provide answers to questions. Usually experiments involve exacting measurements — lots of them —and they're conducted in laboratories under safe, controlled conditions.

But not always. Some experiments are more extreme. Like Jake Socha's.

For his research project, Socha tossed snakes from a third-storey balcony. Flying snakes, that is. Poisonous ones.

Jake Socha, a graduate student at the University of Chicago, had an interest in the mildly poisonous paradise tree snake. In its native Asian habitat, the slender metre-long snake hunts for food and dodges enemies by flinging itself from one tree to the next. But did the paradise tree snake really fly? If it did, how? To find out, Socha designed an unusual experiment.

He constructed a launching station using a cardboard box with a sliding back wall. Then he perched the box on a third-floor balcony, put one of the snakes inside, and by sliding the rear wall, gently pushed the snake out.

Socha videotaped four snakes and seventy-four separate flights. He found that the tree snake doesn't really fly. It glides. As the snake leaps forward, it flattens itself to increase its surface area. Then it flexes and stretches its muscles, twisting itself in mid-air in order to propel and steer itself.

A strange experiment, but useful. To find answers, sometimes scientists — wisely or not — resort to unusual methods. Their experiments go one step farther than normal. They go to extremes.

Struck by Lightning

When storm clouds blew over Philadelphia in the summer of 1752, most people headed indoors.

Not Benjamin Franklin. He went outside to fly his kite.

Franklin was a well known American statesman, inventor, doctor and author. He had a reputation for testing new and unusual ideas, so most citizens of Philadelphia were not too surprised to see him trekking through the rain carrying a kite. In fact, many of them probably thought this was pretty mild behaviour considering the stories that had been told about him.

Take his famous dinner party. In 1750, so the story goes, Franklin hosted a Christmas dinner party for some close friends. Being a bit of a showman, he decided to astound them by using an electrical shock to kill the turkey they would be having for dinner. Little was known about electricity in those days, but that didn't stop Franklin. He had built a primitive battery system, one that could store large amounts of electricity for a period of time. His plan was to use the charged battery to electrocute the turkey.

All was ready. The guests had gathered. The batteries were charged. The unfortunate turkey waited nearby. Then Franklin made a mistake. He began to talk to one of the guests. Without thinking, he leaned against one of the batteries. A huge spark lit up the room as a jolt of electricity raced through his body. The shock knocked him to the floor.

After recovering, Franklin recalled the bang and spark of the discharge. How very much like lightning and thunder, he thought. Then his mind made an enormous leap: Could lightning be a huge jolt of electricity?

By the time a storm struck in June of 1752, Franklin was ready to find out. In a clearing he had walked to, he launched a kite. A metal spike fixed to the kite would attract electricity, if there was any, he figured. Attached to the lower end of the kite was twine, a weak conductor of electricity. And at the end of the twine was a silk

ribbon, a non-conductor. Between the twine and the ribbon, Franklin fastened a key.

As he hoped, electrical charges collected on the spike and travelled down the string. When Franklin touched the key, there was a spark and a small jolt of electricity.

Franklin was lucky not to have been killed. In fact, he may not have known just how foolish —or how lucky! — he really was. When Russian scientist G.W. Richman tried to repeat Franklin's kite experiment his kite was struck by lightning and a 30-centimetre spark of electricity leaped from the ungrounded wire to his head, killing him in an instant!

Franklin's dangerous stunt proved what he had suspected. Lightning was indeed electricity. It also gave him another idea: If the key and spike could transmit electricity, maybe other conductors could do the same thing.

Franklin was so convinced of his findings that he ran a wire from the roof of his house to the ground. At one point lightning struck his roof, but was safely diverted through the wire to the ground. Franklin had created the lightning rod, a device we use to this day to protect buildings from lightning strikes.

- **Bell-ringing in Europe and England around Franklin's time was a hazardous activity. When storm clouds gathered, church bells would be rung violently in an effort to disrupt the lightning and to scare away evil spirits. Church steeples, however, were usually the highest points in town, so they often attracted lightning flashes. Records show that from 1753 to 1786, lightning struck 386 church towers in France alone and killed 103 bell ringers.**

- **In the 1700s, gunpowder was often stored in church vaults — a dangerous practice considering the number of lightning strikes churches suffered. In 1769 a lightning bolt struck the tower of one church in Europe where 91 tonnes of gunpowder had been stored. The explosion rocked the entire city, levelling one-sixth of it and killing 3000 people. Once Franklin's lightning rod was installed in churches, their safety record greatly improved.**

Dateline: Science
Understanding the Enemy

Snap your fingers. That probably took about a second to do. In that same moment, lightning flashed at least a hundred times in different places around the globe.

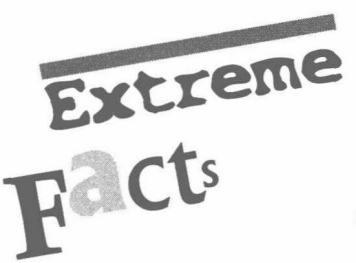
Lightning strikes can cause personal injury, even death. They can also start forest fires, disrupt electrical services, fry computers, knock out entire communication systems and disable aircraft. Needless to say, lightning can be a powerful enemy. But knowing and understanding the enemy can be the first step to victory. That's why a dedicated bunch of modern scientists continue the work started by Benjamin Franklin. Instead of kites and string, however, they're using an arsenal of high-tech equipment to get close to the action.

Most of that action is inside storm clouds. That's where charged particles collect and separate, building up to enormous levels until they discharge in a gigantic surge of electricity. To get close to the action inside storm clouds, scientists resort to some clever methods.

One way is to fly close. Using high-altitude planes that travel at

700 kilometres per hour, scientists fly above approaching storm clouds. Then they take pictures of lightning and use sensitive equipment like computers, scanners and lasers to record information about electrical fields. More data is collected from space too. Videocameras in space shuttles capture images of lightning strikes that can be analyzed later.

Because no one knows exactly where or when a discharge will occur, scientists sometimes use rockets to trigger lightning strikes in a controlled way. When a thunderstorm appears on the horizon, small sounding rockets are launched into its centre. Attached to the rockets are long copper wires with electronic sensors near the end. When the rocket is struck by lighting, the wire is vaporized, and the sensor transmits information about the discharge to scientists below.



- **You've likely heard the expression "as quick as lightning." That's fast. Lightning can jump from cloud to ground in 1/10,000 of a second, travelling at an amazing 100 000 kilometres per second. That's almost a million times faster than sound travels.**
- **There's power in lightning. If the energy from a single stroke of lightning could be harnessed, it could lift a mid-size car 100 kilometres into the air.**
- **At any given moment, there are 2000 thunderstorms occurring around the globe, producing an average of 100 flashes per second.**
- **A lightning flash is usually composed of four separate strokes or discharges.**

Human Guinea Pig

Robert Chesebrough figured he had invented the perfect gel, a heal-all miracle spread guaranteed to soothe cuts and burns. Trouble was, he had to prove it . . . and the only guinea pig he had was himself.

Chesebrough, a twenty-six-year-old businessman, first stumbled upon his wonder gel while visiting the oilfields of Pennsylvania in 1863. He noticed one man scraping a black waxy substance from the machinery, then loading it into buckets to be hauled away.

"What is that stuff?" Chesebrough asked.

"Rod wax," the man answered. "Leftovers from the oil. It coats the pumps and slows them down. Got to get rid of it."

Chesebrough was about to turn away when the man continued, "The stuff's a nuisance, but the men sure love it. A little bit of this on a cut or scrape fixes it right up."

Suddenly interested, Chesebrough grabbed a bucket and filled it with rod wax. Maybe if he could get rid of the smell and the awful colour, he thought, the stuff had possibilities. After all, people were always on the lookout for quick-acting potions and salves.

At home Chesebrough started a series of experiments. Over the next ten years, he heated, mixed and processed the rod wax. In the end, he created the perfect formula — a clear, light-coloured, odourless gel.

But would it heal wounds and burns? There was only one way to find out. Test it. Find a subject with scrapes and cuts, apply the soothing salve, then wait and see. But where would he find someone with such an abundance of injuries?

Chesebrough decided to test the gel on himself. He inflicted dozens of cuts, bruises and burns to his body. Some he left untouched. Others he smothered in gel. When those wounds healed, he cut or burned himself some more. Before long his body looked like a patchwork quilt of injuries in various stages of repair.

The salve seemed to work. Wounds coated with it hurt less and healed faster. Would it work as well on other people? Chesebrough

wondered. To find out, he stationed himself at construction sites, places guaranteed to provide a continuous flow of injuries. Sure enough, when workers hurt themselves Chesebrough was there, ready to apply his salve.

His subjects loved the gel. They claimed it soothed their pain and helped to heal wounds in record time. Convinced of its merits, Chesebrough bottled the gel and sold it to the public. Today Vaseline — the name he gave it — is still sold in grocery stores and pharmacies everywhere. As for Chesebrough, he claimed that daily doses of Vaseline gave him good health and long life. Perhaps it did. Chesebrough died a wealthy man in 1933, at the age of ninety-six.

Although today many newer ointments and salves for healing cuts and burns are available, Vaseline is still one of the most popular skin moisturizers around.

Being a guinea pig in your own medical experiments isn't exactly a wise practice, but Chesebrough wasn't the only person to do it.

- **In 1953 Dr. Jonas Salk was on the brink of discovery. Across North America there had been an epidemic of polio, a disease that causes paralysis and even death. Salk had been working on a life-saving polio vaccine. With Salk's vaccine, people were injected with weak or dead polio germs in order to build up an immunity to the disease. But did the vaccine actually work, or would it, as some people feared, *infect* people with the disease instead?**

  Although there had already been