

Life and Lightning

The Good Things of Lightning

Life and Lightning
The Good Things of Lightning
1st Edition

Vernon L. Mangold, Ph.D.

Electromagnetic and Environmental Protection Consultants
Orlando, Florida

Universal Publishers/uPUBLISH.com
USA • 1999

Life and Lightning, 1st Edition.

Copyright © 1999 by Dr. Vernon L. Mangold

All rights reserved. Printed in the United States of America. No part of this book may be used or reproduced in any form or by any means, or stored in a database or retrieval system, without prior written permission of the publisher except in the case of brief quotations embodied in critical articles and reviews. Making copies of this book for any purpose other than your own personal use is a violation of United States copyright laws. For information, address EEP, 8121 Forest City Road, Orlando, FL 32810.

ISBN 1-5812-796-0

This book is sold as is, without warranty of any kind, either express or implied, respecting the contents of book, including but not limited to implied warranties for the book's quality, performance, merchantability, or fitness for any particular purpose. Neither EEP nor its dealers, distributors, or publishers shall be liable to the purchaser or any other person or entity with respect to liability, loss, or damage caused or alleged to be caused directly or indirectly as a result of this book or its contents.

Published by:
Universal Publishers/uPUBLISH.com
www.upublish.com/books/mangold.htm

Table of Contents

Forward	1
Introduction	2
Lightning – A Force For Life	5
Lightning Renews Life through Fire	9
Lightning Nutrients for a Living Earth	13
The Sound and Rhythm of Lightning	18
Man’s Dependence in the Charged Atmosphere	22
The Charging of the Atmosphere Begins With lightning	22
The Creation and Maintenance of the Charged Atmosphere	26
Lightning Induced Effects on Rain	31
Harnessing the Electrical Energy in the Atmosphere.	33
Atmospheric Electricity and its Effects on Pollution	33
Lightning’s Effect on Cleaning the Atmosphere of Sub-micron Particles.	35

Biological Affects Associated With Lightning	41
Vegetation.....	44
Reduction of Lightning Activity.....	50
Conclusions.....	55
Appendix A. Types of Lightning Discharges And Flashes.....	56
Cloud-to-Ground Lightning.....	60
Intra-Cloud Lightning.....	60
Cloud to Cloud Lightning.....	60
Heat Lightning.....	61
Cloud-to-Air Lightning.....	61
Sheet Lightning.....	61
Ribbon Lightning.....	62
Bead Lightning.....	62
Ball Lightning.....	63
St. Elmo’s Fire.....	63
Appendix B. Lightning-like Discharges.....	64
Volcanic Induced Lightning.....	64
Nuclear Detonation Induced Lightning.....	64
Tornado/Waterspout Induced Lightning.....	65
Dust/Sand Storm Induced Lightning.....	65
Appendix C. The Signature of Lightning.....	70
Appendix D. Summary Guide for Personal Safety During Thunderstorms.	73

Personal Safety During Thunderstorms	73
Be Watchful For Thunderstorm Activity	73
Cloud Formations Associated with Thunderstorm Activity	74
Appendix E.	80
Glossary.....	80
Units of Measure.....	86
Appendix F. Other Suggested Reading.....	91

Foreword

This book was written to address those features of lightning that are beneficial to mankind. The technical level of the subject matter discussed in this book is designed to be readily understandable by the general public. The general emphasis is on the positive aspects of lightning. There are a number of books and thousands of published articles that stress the hazards of lightning to life and property. Lightning is an awesome force of nature and must be respected as such. I have included Appendix C; "A Summary Guide for Personnel Safety During Thunderstorms" which addresses simple steps one can take to help avoid this natural force. Other Appendices are included which discuss the types of Lightning discharges, Lightning-like Lightning, the Signature and color of lightning and other information to assist in the understanding of the phenomena of Lightning.

A large portion of the information used in this book is based on the results of other published work. Any attempt to write a comprehensive book on the subject of "Lightning" without due regard for the experiences and research of others in this technologic discipline would be impossible. The physics associated with Lightning, as we know it today, is based on the results of research and study conducted by many authors.

Lightning was part of the earth's environmental makeup before life appeared on earth. Lightning played an important role in creating life on earth. This same force has assisted in sustaining a livable earth and continues to balance those forces of nature to assure that life continues on this earth in the future. By studying such natural forces as lightning, we can better understand the workings of the past, present, and future of our natural planetary environment.

Introduction

A proposed theory, first reported in 1944, describes the creation of the universe as a result of electrical discharges (primordial-like Lightning) that gradually condensed the matter, consisting of gases and dust into the galaxies and finally into the stars. These lightning-like discharges ultimately condensed the stellar matter into planets and satellites. On our Earth, the electrical discharge phenomena (i.e. lightning), plays an active part in sustaining life and is one of those natural forces that has been around since the formation of the atmosphere.

Man can neither control nor regulate this force and resigns himself to the task of measurement and understanding of this phenomena. It is the purpose of this book to attempt to help one understand the importance of this great force as it was in the beginning of life, its role in nurturing life, and its ability to help sustain life on the earth.

As our earth was cooling down, our atmosphere was condensing from clouds that included small portions of heavy elements dispersed by the formation of the planet. With the oceans established, there was still a void in living matter - "LIFE." It is theorized and laboratory experiments suggest that lightning and ultraviolet radiation were responsible for the synthesis of the organic chemicals that eventually led to the development of life. Along with other natural processes, the primeval thunderstorm (lightning) helped produce molecular oxygen that would flourish in the oceans, on the land and in the atmosphere. Today, eons later, the thunderstorm with its associated lightning continues to nurture the life it helped create.

Lightning provided man with his first source of fire. This fire ultimately "blazed" the trails for the migration of man across the continents of the world. The lightning induced fires that cleared the forest and woodlands created the vast grasslands and thereby provided life and food for ancient man.

The brilliant lightning flashes generate tremendous energy and heat which unite the nitrogen and oxygen in the atmosphere to form nitrates and other compounds. These compounds are then carried to the earth by rain and replenish the supply of fertilizer that the soil needs to produce food.

The electromagnetic "sound" of lightning, which echoes back and forth between the earth's hemispheres, produces radio signals that, when amplified, sounds like the descending pitch of a whistle. By analyzing these signals, there exists a possible means to detect irregularities in the ionosphere and variations in the earth's magnetic field. This type of information could be used to study the upper atmospheric relationships with the sun.

A thunderstorm maintains the charged atmosphere which provides the electrical activity that helps keep the upper atmosphere free of sub-micron particles that could collect and create climatic changes by interfering with the solar energy.

Mankind lives in this electrically charged atmosphere and breathes in the charged air, which is absorbed in the respiratory system. The significance of this fact is that the current levels involved are too small to cause any noticeable effects. As humans, we have evolved and adapted to our natural environments; one of which is the charged atmosphere, which is sustained by thunderstorm activity around the earth. What about tapping into the electrical energy stored in the charged atmosphere for use in providing power for commercial and industrial uses? The electrical energy (lightning is the major source of this energy) stored in the

atmosphere of the earth could supply millions of horsepower continuously if it could be harnessed.

The births of thunderstorms are a function of the surrounding atmosphere and the topography of the earth's surface. The global air circulation patterns control the planet's weather as well as the development of the thunderstorm activity. The earth's air circulation patterns are a function of the motion of the earth and absorption of solar energy. The earth's atmosphere absorbs solar energy and the earth's motion helps establish the movement of the heated air creating a large atmospheric heat engine. The resulting energy builds and forms large cloud masses, high energy atmospheric winds and large atmospheric temperature gradients which pumps tremendous energy into the earth's surrounding atmosphere. One of the natural mechanisms for safely discharging this energy to the earth is through the development of the thunderstorm with its embedded lightning activity. Lightning is necessary to maintain the balance of energy within the earth's natural weather system. Lightning can be credited with performing a vital role in keeping the earth in electrical harmony with the upper atmosphere.

There are other attributes associated with this force of nature such as the production of ozone, which purifies the air we breathe after a thunderstorm. Lightning plays a role in accelerating rain and snow formation, the process by which energy is expended within weather related storm formations and finally the spectacular show provided to man representing the phenomena which helps nature balance the great forces which give life to our planet.

Lightning – A Force for Life

Creation of the earth began with a tremendous amount of energy being expended. This energy, among other things, created huge amount of heat (see *Figure 1*).



Figure 1. Primeval Earth Formation Showing Lightning Activity

As the earth cooled, its atmosphere could not hold all the water vapor that was in it. The vapor began to condense and great thunderstorms poured rain from the sky. These rains continued for years recreating the oceans and the first lightning.

Water, the universal solvent, formed into rain drops which washed carbon dioxide and other soluble compounds out of the air and carried them down to the earth and finally

out to the sea. As the water passed over the earth it picked up other chemicals. Salts too were carried to the sea. These salts and other chemicals were mixed and reacted in the sea to form new chemical combinations which ultimately became the raw materials of life. Among the chemicals washed into the sea were carbon and nitrogen compounds that served as the raw materials from which living things developed. Some hydrocarbons and ammonia may have been left from the first atmosphere, volcanic eruptions were bringing molten rock and gases to the surface which reacted to form hydrocarbons and carbides. The carbides reacted with nitrogen to form cyanamides which reacted with water to produce ammonia.

Water, hydrocarbons, and ammonia are the raw materials out of which amino acids can be made. Two forces which existed at that time which could combine the raw materials into a form of living matter were ultraviolet light and lightning. Experiments in laboratories with electrical arcs which simulate lightning and ultraviolet energy, have proved that they are capable of altering the raw materials to form amino acids. Lightning can produce the synthesis for combining the raw materials to produce Amino-acids in two physical processes; heat from the lightning channel and the shock wave produced by the expanding channel which produces thunder. A large percentage of the electrical energy in a lightning discharge is dissipated in the lightning channel shockwave. The literature indicates that calculations show that ultraviolet light below ** 3000 Angstroms could be 1000 times more abundant than lightning on the primitive earth, but the shockwave from the lightning channel is a million times more efficient in producing Amino-acids - "The start of living matter."

The lightning as we know today was very surely one of the forces that helped create life as it is today. This great force that can destroy and start great forest fires was also one of the great forces that started life on our planet Earth.

** Wavelengths shorter than about 3000 Angstroms is where the organic photochemistry can be expected.

REFERENCES

- FOX, S., "HOW DID LIFE BEGIN,
"SCIENCETECHNOLOGY, FEB. 1968.
- DAUVILLIER, A., "THE PHOTOCHEMICAL ORIGIN OF
LIFE," ACADEMIC PRESS, NEW YORK, 1965.
- OPARIN, A. I., "THE ORIGIN OF LIFE," MACMILLAN
PUBLISHING, NEW YORK, 1938.
- ADLER, IRVING, "HOW LIFE BEGAN," SIGNET
SCIENCE LIBRARY BOOKS, NEW YORK, 1957.
- "THE SEARCH FOR LIFE'S ORIGIN," NATIONAL
ACADEMY PRESS, WASHINGTON, D.C., 1990.
- MELVIN, CALVIN, "CHEMICAL EVOLUTION,"
OXFORD UNIVERSITY PRESS, NEW YORK, 1969.
- BUVET, R. AND PONNAMPERUMA, C., "CHEMICAL
EVOLUTION AND THE ORIGIN OF LIFE,"
AMERICAN ELSEVIER PUBLISHING COMPANY,
INC., NEW YORK, 1971.
- BRUCE, C.E.R., "AN ALL-ELECTRICAL UNIVERSE,"
ELECTRICAL REVIEW, LONDON, 167:1070-1075,
23 DECEMBER 1960.

Lightning Renews Life through Fire

Are lightning-produced fires mans great enemy or are they natures way of stabilizing life on earth? Did lightning "blaze" the trails for the migration of man across the continents of the world? It is postulated that the lightning induced fires were mans first source of fire which he used for heat, light, cooking, and protection.

The existence and finally the control of fire was a major step in man's evolution and mastery over his environment. As the thunderstorm built-up over the prehistoric forest, lightning ignited trees and grasses. When the fires burned themselves out; a small group of hunters moves into the smoldering areas. They find the carcass of a deer, and they taste it. They carry it home; food can be cooked! This miracle of fire was not limited to prehistoric man; an example situation was reported during the seventeenth century among the aborigines of Tasmania. Many of the tribes did not know how to create fire. They lived in an area where there were no active volcanoes. Their source of fire was obtained from forest and brush fires which were started by lightning. These people cherished and carefully nourished this most critical possession. On occasion, the fire was lost due to such occurrences as local flooding. When this happened, they would have to try to barrow fire from other tribes or they would have to go without until the next naturally produced lightning fire. These same lightning induced fires cleared the great forest and woodlands creating the grasslands which provided life and food for ancient man (*Figure 2*).



FIGURE 2. Fire was of critical importance to humanity; it provided warmth, protection and a means of cooking food.

In areas such as Central Arabia, the significance of lightning take on a different meaning: rain is eminent. Swift movement is essential to reach the water before it has evaporated or sunk into the ground. Lightning and its associated thunder herald the coming of rain showers.

The biologist Mr. Edwin V. Komarek, Sr. in his studies of lightning induced fire damage and the surviving ecology balance indicated that natures use of lightning fires for clearing dense wooded areas is indeed beneficial to the ecology. An example of an ecology out of balance was the great timber forest in Oregon's Tillamark. Prior to 1933 the serenely beautiful, hushed and somnolent forest was deserted by living creatures. A fire set by lightning wiped out 250,000 acres of virgin timber. Rather than destroying the ecology, the flames had in fact rejuvenated the environment by killing off the dry - land snail, a carrier of worms that infested the lungs and livers of the local mammalian

population. The fire freed the forest of insects and disease. The bird and animal communities began to thrive in the clearings left by the fire. This is not a unique case in history but rather a typical situation that repeats itself in time, with lightning acting as the agent in plant and animal evolution. In contrast to the above, Nova Scotian Alder Thickets untouched by lightning induced fires, have biologically "died."

The effect on the evolution of plant life is reflected in past literature where it shows that new genes had appeared following a forest and grass fire, and that laboratory experiments with elevated temperatures doubled the number of chromosomes of some species. One set of fifteen buds exposed to high temperatures yielded twenty-one offspring, all with differing characteristics from the parent plant; seven had strange characteristics never seen before.

Lightning fires in Alaska and Canada regularly clear the nesting sites for the migratory birds, the development of grasslands due to lightning induced fires in forest areas encourages the reproduction of moose in Alaska, elk in the Rockies, deer in California and the Everglades, snowshoe rabbits in Wisconsin and Minnesota, prairie chickens in Texas and Louisiana, wild turkeys from the Carolinas through the Mississippi valley and ducks and geese along the southeast seaboard of the Atlantic.

REFERENCES

LEAR, JOHN, "LIGHTNING AS A SCULPTOR OF LIFE",
SATURDAY REVIEW, 49:57-62, JUNE 4, 1966.

KESSLER, EDWIN, "THE THUNDERSTORM IN
HUMAN AFFAIRS", UNIVERSITY OF
OKLAHOMA PRESS, NORMAN, OK, 1983.

CLARK, GRAHAME AND PIGGOTT, STUART,
"PREHISTORIC SOCIETIES", ALFRED A. KNOFF,
INC., 1965.

WALLACE, RONALD L., "THOSE WHO HAVE
VANISHED", THE DORSEY PRESS, CHICAGO, IL,
1983.

BLUMENSTOCK, DAVID I., "THE OCEAN OF AIR",
RUTGERS UNIVERSITY PRESS, NEW
BRUNSWICK, NJ, 1959.

Lightning Provides Nutrients for a Living Earth

Lightning helps man produce food and helps keep the plant life abundant by producing nitrogen in a form which can be used to fertilize the earth's soil.

Lightning is a natural short-lived high current electrical discharge which takes place in the atmosphere. This lightning and the associated corona (point discharges) are a source of the production of charged particles (i.e. ions) in the earth's atmosphere. Ions are electrical charged atoms and/or molecules that create an electrically conducting medium. Air ions are electrically charged air particles that have taken up an electrical polarity of either positive or negative.

As the lightning arc passes through the atmosphere it separates the nitrogen (N_2) into ionized nitrogen which unites with the oxygen to form nitrites (NO_2) and nitrates (NO_3). The source of these nitrites and nitrates are from the atmospheric gases. The composition of the gases that makes up our atmosphere is shown in *Table 1*.

The nitrogen molecules readily dissolve in water droplets and rainwater and are washed into the earth below. This natural cycle is shown in *Figure 3*. Each bolt of lightning produces a small amount of organic nitrogen. However, there are more than 8 million lightning flashes per day distributed across the earth which produces an sufficient amount of organic nitrogen. It is estimated that there is approximately 100 to 400 million tons of organic nitrogen produced by lightning storms per year. The world surface area is approximately 5×10^8 km². Therefore dividing this area into 100 to 400 million tons would yield nearly 2 to 8 pounds of organic nitrogen for every acre on the surface of

the earth. While it is not assumed that all of the fixed atmospheric nitrogen is generated within the lightning flash, it is important to note that the thunderstorm systems, which includes lightning contributes significantly to the world's source of fixed nitrogen.

GAS	PERCENT OF ATMOSPHERE
Nitrogen	78%
Oxygen	21%
Argon	0.93%
Carbon Dioxide	0.04%
Helium, Neon, Hydrogen, Ozone	0.007%
Krypton, Xenon	0.02%

Table 1. Gaseous Composition of the Atmosphere

Every organism needs nitrogen to survive. It is found in all cell nuclei, constituting about 16 percent of the proteins, which are the building blocks of healthy plant and animal tissue. There are two forms of nitrogen; inorganic and organic. The inorganic nitrogen is an inert gas (N_2) which makes up three-fourths of the air we breath. Almost all the earth's nitrogen is in this form. Plants and animals can not assimilate inorganic nitrogen. The organic nitrogen is a rare form created by separating inorganic nitrogen (N_2) and then putting it back together with oxygen so that it can

be assimilated by plants and animals. This process is called nitrogen fixation whereby nitrites (NO_3) are processed.

Organic nitrogen is vital for life and is in constant demand. The process of fixation requires a vast amount of energy. There are few organisms capable of meeting these high metabolic requirements. To further complicate the production of organic nitrogen is an entire group of denitrifying bacteria which try to undo what the nitrifying bacteria species have done.

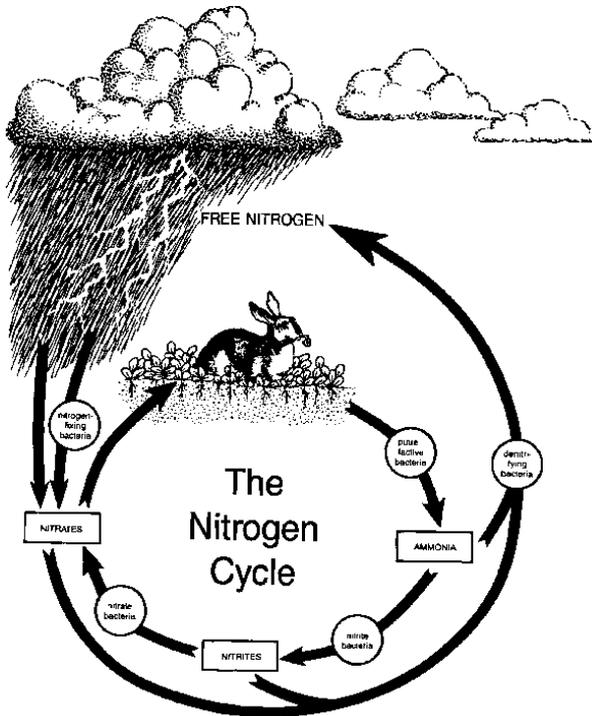


Figure 3. The Natural Nitrogen Cycle Produced By The Atmospheric Electricity.

This all means that either the forces of nature (thunderstorms) or artificial means must be used to supplement the nitrogen to the earth's soil. The artificial means is manmade nitrogen fertilizer, but this represents an energy loss, since plants grown from such fertilizers can never yield as much energy as was required to produce and transport the artificial fertilizers in the first place.

Fortunately, man has the thunderstorm with its embedded lightning working in his behalf as an important secondary source of organic nitrogen to help keep life as we know it sustained on our planet.

REFERENCES

LANGA, F.S., "FLASHES OF FERTILIZER IN THE SUMMER SKY," ORGANIC GARDING, 26:67-9, AUGUST 9, 1979.

STAFF,"LIGHTNING ACTS AS SOIL FERTILIZER," SCIENCE DIGEST, 11:47, APRIL, 1942.

STAFF,"LIGHTNING BENEFICIAL," SCIENTIFIC AMERICA, 172:52, JANUARY, 1945.

VIEMEISTER, P.E., "LIGHTNING AND THE ORIGIN OF NITRATES IN PRECIPITATION," JOURNAL OF METEOROLOGY, VOL. 17, NO. 6 DECEMBER 1960.

IRIBARNE,J.V.AND CHO, H.R., "ATMOSPHERIC PHYSICS," D. REIDEL PUBLISHING COMPANY, DORDRECHT, HOLLAND, 1980.