OSIRAN

friend earthworm

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THE PRACTICAL APPLICATION
OF A LIFETIME STUDY OF THE MOST
IMPORTANT ANIMAL IN THE WORLD.

by

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Contents

Business is Business

"Business is Business," the Little Man said,
"A battle where everything goes,
Where the only gospel is 'get ahead,'
And never spare friends or foes.
'Slay or be slain', is the slogan cold.
You must struggle and slash and tear,
For Business is Business, a fight for gold,
Where all that you do is fair!"

"Business is Business," the Big Man said,
"A battle to make of earth
A place to yield us more wine and bread,
More pleasure and joy and mirth.
There are still more bandits and buccaneers
Who are jungle-bred beasts of trade,
But their number dwindles with passing years
And dead is the code they made!"

"Business is Business," the Big Man said,
But it's something that's more, far more;
For it makes sweet gardens of deserts dead,
And cities it built now roar
Where once the deer and the gray wolf ran
From the pioneer's swift advance.
Business is Magic that toils for man.
Business is True Romance.

And those who make it a ruthless fight
Have only themselves to blame
If they feel no whit of the keen delight
In playing the Bigger Game,
The game that calls on the heart and head,
The best of man's strength and nerve.
"Business is Business," the Big Man said,
And that Business is to serve!

—Berton Braley

Part I

Introduction

There must be something wrong somewhere — Nature's laws governing these errors — What is wrong when we have so many human ills? — When we have want in a land of plenty? — Why not old age pensions? — Why poultry dies young — The earthworm as an answer.

There must be something wrong somewhere.

There is want in a land of plenty—nationwide unemployment with factories idle and work to be done. The elderly must depend upon charity or insufficient social security. Fruit trees are chopped into firewood because they die many years before their natural span of life has been completed. Poultrymen and farmers find their livestock dying a premature death by wheelbarrow loads.

There certainly must be something wrong somewhere.

Why should modern man labor under these distressing and unnatural conditions? Are they the fault of a blind and disinterested nature? Or are they of man's own making?

It is the purpose of this book and the lessons it contains—for all books and teachings without purposes are empty things—to encourage the reader to find the something that is wrong and, where possible, alleviate it.

At this point, I wish it definitely understood that I am not coming forward with a new theory, or fad, or panacea for all our individual and collective ills and disorders. What appears in the following chapters was especially prepared for farmers, orchardists, nurserymen, poultrymen, gardeners, trout-farmers

and all persons interested in such matters. It is founded on scientifically established data, approved by eminent authorities, and designed by, and functioning through, natural law—the only law from which there is no recourse, no appeal, no hung juries.

Not only are Nature's laws foolproof, but they are as irrefutable and enduring as the laws of mathematics—and two and two will make four as long as numerals are used as media with which to count. And Nature's laws need no policemen, for they are guardians within themselves.

Probably the chief cause of most of humanity's mental and physical disturbances is too much food of the wrong sort, and too little of the beneficial sort. Properly balanced food means a well balanced and healthy body, and such a body contributes to the mental wellness of its owner, or, if you prefer, a spiritual wellness.

When there is want in a land of plenty.

Here indeed is a paradox. If it were humanly possible to keep politicians from signing politically expedient documents and statutes; gag them to silence their similarly expedient utterances and purge their thoughts of forthcoming elections, a fair distribution of the nation's wealth could become a reality. Here, again, we may safely disregard man's laws and turn to natural laws, for an answer.

In Nature there is no waste. Everything—animal and plant, when its life is terminated—returns to its original elements, either in the soil or in the waters. Here, through chemical reactions, it is broken up and again becomes a beneficial part of these elements. Man's laws not only permit waste, but actually seem to thrive upon it.

This is particularly true in political, governmental and social spheres. Modern civilization, of which our American loose-leaf form of Democracy is a major part, seems incapable of producing unselfish statesmen. As examined by the thinkers and philosophers of the world today, general conditions point unmistakably to a

decrease of intellectual and moral fiber in those who are elected, or take by force, the responsibility of public affairs. America's financial, industrial and commercial systems need revamping by humanitarians, not politicians. The fact that these systems are all-powerful, as well as gigantic, should not give them a license to act as dictators.

In truth, America has less to fear from a political dictatorship than from a financial, industrial or commercial dictatorship. Certainly no reasonable or reasoning person will deny that our financial system, so cleverly interlocked with the international system, needs a thorough house cleaning. Were this done, and done according to the principles set forth in the Constitution of the United States, industry and commerce would be forced to change their tactics and operate in a less plutocratic, dictatorial and monopolistic manner.

And again we may safely turn to Nature. She does not permit monopoly. Nowhere in either the animal or plant kingdoms will one find monopolistic tendencies. Monopoly, political, industrial or economic, while it is undoubtedly beneficial to a few, is destructive to the masses. In the final analysis, monopoly is self-destructive, and any system that has within it the germ of self-destruction brings widespread disorder to other systems directly or indirectly related to it.

Essentially, monopoly is a form of greed and the similarity is decidedly expressed by calling the reader's attention to a pig pen at feeding time. Invariably, the fattest porker will push and shove and shoulder its way to the feed trough. In its greed, it comes very close to monopolizing all the available food. Thus it grows faster and fatter than the others in the same pen—and reaches the slaughterhouse first! Here we observe how greed and monopoly ultimately leads to destruction.

When old age must depend upon charity or a social security that does not secure.

Do natural laws ordain that the aged, animal or plant should suffer in their senile or infirm years? Definitely, no. Having lived naturally, all animals and plants complete their cycle of life in an even tenor, barring, of course, accidents, which are as much a part of Nature as the ebbing and flowing of the tides. Through progress, enlightenment and education—the latter being far less perfect than our paid scholastics would have us believe—we have graduated from many primitive customs which ordered that the elderly of some races, being senile, and therefore unproductive, should be destroyed.

Yet, the system we boastful Americans employ in caring for our elderly is relatively not far removed from the barbarous system of killing the old. Today we do not kill our elderly outright. We condescend to permit them to slowly starve or freeze to death, making them all the while more susceptible to the ills that come with old age.

Many Americans make the elderly a political football to be booted about the political gridiron. In considering the problem of our elderly, politicians obviously refuse to consider Nature. Probably, few of them realize that mutual aid is a natural law; that very early in the nineteenth century, philosophers dimly developed the theory that in every branch of Nature mutual aid is as permanently fixed as the laws of conception and demise.

It was Professor Kessler who, in 1880, while Dean of the St. Petersburg (now Leningrad) University, declared reciprocity to be a natural law. Prince Peter Alexevitch Kropotkin, Russian geographer, having absorbed Professor Kessler's declaration that mutual aid in Nature was irrefutable, wrote and published (1902) his great work *Mutual Aid as a Law of Nature and a Factor of Evolution*.

What both of these men know, or should know, is that the soil is deficient in one or more vitally necessary ways or elements. The orchardist who begins "guessing" about what is wrong with

his soil is playing an ultimately losing game. The law of averages is against him. Such a man, desiring to learn the true nature of his soil, the element or elements it lacks or with which it may be over supplied, should have samples of his soil analyzed by capable chemists. Most soils are deficient in elements necessary for plant life not because the elements are not present, but because they are unavailable to the plant roots.

It is into this picture that the burrowing earthworm makes its appearance. All the elements that are in the soil, but which are hidden and unavailable to the plant roots, are broken down by the earthworm and made available. Man has yet to invent, devise or manufacture any machine, any solid or liquid fertilizer as efficient as the earthworm. In this invertebrate animal, Nature has a perpetual soil builder, a four-in-one creature that acts upon the soil as chemist, triturator, cultivator and distributor—as shall be seen.

When poultrymen find their chickens dying a premature death by wheel barrow loads...

For over a quarter of a century, Southern California has been a mecca for thousands of individuals and families trekking here to enter the poultry business. Scattered, estimated and authentic figures give us the information that, in a period of fifteen years, well over 50,000 such business ventures failed. Among those who have managed to remain in business are many who suffer a poultry mortality that is astounding. One set of figures shows that some sixty percent of pullets die before they reach maturity. Others show that fifty-five percent of laying hens have to be replaced every second year, when they should live and be productive for from four to six years. Still other data point out that it costs many poultrymen twenty cents a dozen to produce eggs, when thinking members of their business are producing the finest eggs for less than ten cents a dozen. Poultry raisers and breeders of fowls for meat seemingly have great difficulty in producing birds with a necessary amount of feathers on them.

Why do such conditions exist in the poultry business? When we come to the portion of this work that deals with poultry, we shall learn that the cause of all these conditions is in the poultryman himself. It is not the nature of domesticated fowls, nor is it Nature's design, to suffer such a high mortality rate, produce sterile eggs, or half bald chickens. For over forty years, this writer has known and demonstrated the fact that, if there is little or no deficiency in the diet poultrymen feed their flocks, there will be a minimum of premature deaths, unfertile eggs, and featherless birds. It is no idle remark, no promise of magical prowess, no guesswork to declare that all of these adverse conditions may easily be remedied by the proper application of the earthworm, as we shall eventually see in a chapter devoted to this subject.

The statement taken for our premise—"there must be something wrong somewhere"—may be accurately changed to "there *is* something wrong somewhere."

It is the aim of this book to point out what and where that wrong is and how it can be overcome. Around and upon one word—earthworm—is built the highway to better and more productive trees, plants, vegetables, poultry, game birds and fish.

Such an animal as the earthworm, whose importance is universally accepted and admitted by scientists, deserves a more pretentious volume than this humble effort of mine. But I find solace and satisfaction in having prepared a book for the lay reader in which I have eliminated, as much as possible, the use of confusing technical and long, jaw-breaking zoological terms.

In preparing this work, I have included data about the earthworm that has long been recognized and admitted by men and women of science. In addition, I have included many facts which I have discovered through nearly half a century of experimentation.

This work was planned to be of especial interest to farmers, orchardists, nurserymen, gardeners, poultrymen and all others interested in agriculture, horticulture and their kindred professions. However, it will, I hope, be welcomed as an instructive

review of the life and habits of the annelids discussed herein.

In offering this work to the public, I sincerely hope that it will add, to an already long list, many new and appreciative admirers of our friend, the earthworm.

—*George Sheffield Oliver*

Lesson 1

History of the Earthworm

The animal kingdom — Earthworm low in animal life — Description of various types of worms — Charles Darwin's opinion — What is "Dry land?" — External description of the earthworm — Internal description — Its sexual life — The eggs of earthworms — Their progeny

The animal kingdom is divided into two subkingdoms, invertebrate and vertebrate animals—animals with backbones and animals without backbones. The invertebrate group is distinguished by nine phyla, or divisions. In this group there are over 500,000 known kinds of animals, ranging from the lowest form of animal life, minute single-celled protozoa, to arthropoda—crabs, insects and spiders. In the vertebrate group there are well over 30,000 known kinds—fishes, amphibians, reptiles, birds and mammals.

When it is stated that in this vast array of creatures the lowly, segmented earthworm is probably the most important to mankind, most may find that illogical and unreasonable. Yet, few creatures equal the burrowing earthworm as being essential to better health and greater growth to plant and vegetable life. Therefore, indirectly, it is of the utmost importance to man.

The burrowing earthworm is Nature's plow, chemist, cultivator, fertilizer, distributor of plant food. In every way, the earthworm

surpasses anything man has yet invented to plow, cultivate or fertilize the soil.

While it is unquestionably true that plants and vegetables grow and reproduce their kind without the aid of the earthworm, most naturalists claim that all fertile areas have, at one time or another, passed through the bodies of earthworms.

It is also true that the finest plants and vegetables become healthier and more productive through the activities of this lowly animal, which the ordinary person considers useful only as bird food or fish bait.

The earthworm has been playing a very important role in the drama of plant life from time so distant that scientists can merely guess as to the age of this invertebrate animal. Regardless, scientific men are agreed that mankind may rightly acknowledge the earthworm as one of his best friends.

In this chapter, or lesson, the reader will be presented with a brief genealogical background of the earthworm and the manner in which it has indirectly aided mankind by directly aiding plant life. This background should help the reader to understand facts regarding the earthworm which should be known to anyone interested in gardening, farming, orcharding or poultry raising.

If must first be realized that there are worms and "worms." All are invertebrate animals. This work shall be focused on only the *phylum annelida*.

The division of invertebrate animals, of which the earthworm is a member, is composed of five families or classes. These, in turn, are divided into two orders. The *phylum annelida*, the entire division of earthworms, contains upward of eleven hundred species.

Of this extensive array, we shall concern ourselves only with earthworms, for there are marine worms, swamp worms and beach worms, many of which appear to be "just worms."

While all *annelida* are, more or less, closely related, each specie has distinct features. Some have habits quite foreign to other species. Some prosper only in certain, specific environments and

die if transplanted elsewhere. Some have definitely formed heads, with whiskers, teeth and eyes. Others have no heads, are toothless and eyeless. Some worms are hermaphroditical, others bisexual. Some live exclusively in water, others in soggy soil, others in decayed animal matter (manure), others in decayed vegetable matter (humus).

Low as earthworms are in the scale of life, they show unmistakable signs of intelligence. Charles Darwin's experimentations with them conclusively proved that instinct alone could not guide them so consistently. (See Darwin's famous work, *The Formation of Vegetable Mould Through the Actions of Worms, with Observations on Their Habits.*)

Some earthworms come to the surface of the soil and can crawl a great distance, especially in rainy weather, when their burrows or tunnels are flooded. All throw their bodily excrements, technically known as castings, behind them. Some species throw their castings above the surface of the soil, forming small hillocks or mounds.

Countless thousands of years before the rocky surface of the earth disintegrated to form what we call soil, an extensive list of animals and plants lived in the waters. Marine worms were undoubtedly present in those obscure ages.

In time, as the waters receded, various animals and plants evolved certain anatomical organs to meet the new conditions. Some marine worms acquired physical characteristics which permitted them to live, first in very marshy ground, later in "dry land."

The phrase, "dry land," should here be qualified, for, in the strictest sense, there are exceptionally few spots on the face of the earth that are dry. No creature can live on, or in, dry land. It is a common remark, "we breathe air," but what we are actually doing—what all living things are doing—is breathing nitrogen dissolved in water.

We should keep this fact regarding the vital need of water constantly before us as we study the worm and its relation to plant

life, for both must have moisture to live.

Now that we have cursorily traced the earthworm from its parent environment to the so-called dry land, we will focus on those known to science as *Oligochaeta*.

This group is composed chiefly of terrestrial worms, and is the subject of this book.

The earthworms, like all other families, is sub-divided into various groups, but for our purpose all we need know are the common names for this class. These are orchard worm, rain worm, angle worm, dew worm, brandling, compost worm, night crawler, fish worm, night lions and similarly descriptive names familiar to certain areas of the United States.

Let us now combine all these common names and visualize the last earthworm we saw.

In size, it may have been from two inches to perhaps a foot in length. Although, twelve inches is long for an earthworm on the North American Continent, except in very damp forest lands.

In considering an external description of the earthworm, we find all species so much alike that few can distinguish one species from another without careful examination.

All are "headless," eyeless and toothless. There are no external antennae or feelers. From tip to tail the body is composed of ringlike segments. A short distance from the "head" is seen a band, which is lighter in color than the rest of the body.

That, briefly, describes how the earthworm appears to the naked eye. The earthworm's internal system is highly complicated. Yet, paradoxically enough, it is magnificently simple. Picture a flexible metal tube the size of a lead pencil, in which is built a plant capable of refining gasoline from crude oil. In a comparative sense, the earthworm's system does to soil what the modern refinery does to crude oil.

The earthworm has a multiple system of hearts, minute tubes circling that part of the alimentary canal between the pharynx and the crop. Through a complicated system, these hearts supply blood to all parts of the body.

Minus lungs, the earthworm "breathes" through its moist epidermis or outer skin. The blood corpuscles are colorless and float to the surface of each segment where they absorb oxygen.

Under an ordinary magnifying glass, the pores of the various segments are visible. If one were to gently squeeze an earthworm, minute drops of yellowish serum would be seen coming out from it.

This serum is composed chiefly of oil of high medicinal value. Experiments for its extraction, discussed in a later chapter, are now in progress. It is hoped that this oil may be extracted in quantities sufficient to encourage production.

Except for a number of hearts, all the vital organs of the earthworm are under the previously mentioned band, which zoologists call the *clitellum*. This band is the chief characteristic of the earthworm, distinguishing it from all other worms except a few leeches and a few other marine worms.

Under this band, in compact uniformity, are seminal vesicles and receptacles, testes, ovaries, oviduct and egg sac. Directly behind these is the crop, where the food is held until the gizzard, just beyond the crop, is ready to accept it. Next follows the intestine, a distinctly oval shaped tube, and then the rest of the alimentary canal to the vent or anus.

Our earthworm is bisexual, containing both male and female organs of procreation, and must perform a reciprocal act of copulation to fertilize and be fertilized.

The sexual act of the earthworm, usually occurring in the cool hours of the early dawn and twilight, makes an interesting and curious study of nature's method for propagating the specie.

Neither animal has external sexual organs, though the pores, through which the seminal fluids appear, are visible under a small magnifying glass. The sexual act is not preceded by any display of amorous cooing or lovemaking. The worms, driven solely by instinct when the procreative glands demand relief, seek a position that brings their bands together and remain thus, quite motionless, for as long as fifteen minutes. If exposed to a bright

light during the sexual act, the embrace is broken. Worms, though sightless, are very susceptible to light.

During the act of coitus, each worm exchanges male sperm, impregnating, or, at least, theoretically impregnating, their female ovas. Also during the act, there is an increased flow of the fluid which keeps the entire length of the worm's body moist. This fluid forms the capsule in which the eggs are deposited. It is heavier and thickens rapidly.

When the hymeneal act is completed and the earthworms separate, this fluid forms an outer band. The new band or shield begins to move forward, eventually dropping from the earthworm's "head."

During the forward movement of the gelatine-like band, the impregnated eggs are held firmly within. As it drops off the earthworm, it closes into a yellowish-green pellet or capsule, slightly larger than a grain of rice. This capsule resembles, to a remarkable degree, a very small currant.

Earthworm capsules examined under a powerful microscope show a lack of uniformity in the number of cells. There will be, however, from three to fifteen fertile eggs in a capsule.

Earthworm eggs hatch in about twenty-one days. The newborn appear as short bits of whitish thread about one-quarter of an inch in length. In twelve to forty-eight hours, they become darker but are visible to the untrained eye only after a painstaking search for them.

Once hatched, it is a case of each worm for itself. Close observation seems to lead students of these lowly organized creatures to believe their mortality rate exceptionally low.

Worms begin to mate from sixty to one hundred days after birth, depending upon the richness or poorness of the soil in which they live or in which they are cultured.

Mating follows at periods from six to eight days. If we are to follow the average fertility of each capsule laid, that is, three worms, one mature worm will beget over one hundred and fifty worms each year of its life. Each mating, should produce twice

that number, or over three hundred worms a year.

Certain species of earthworms, particularly those that come to the surface and crawl about during wet or rainy weather, seem to be chiefly active during the nocturnal hours. Other species—which we will discuss later—are, apparently, active throughout most of the day and night. This specie seldom, if ever, comes to the surface, depending on the porosity of the soil.

Except in highly porous soils, the earthworm must eat its way through. Having no teeth, everything before it, if not too large to swallow, is sucked into the mouth. It is a ravenous eater.

Every morsel of soil and decayed vegetable and animal matter taken in by the earthworm passes through its digestive system. This is equipped with a gizzard-like organ. Here the food value in the swallowed matter is extracted for use by the worm. The rest is carried by muscular action down through, and out of, the alimentary canal. This waste matter is called castings.

Lesson 2

The Habits of the Earthworm

Terrestrial earthworms differ from other annelids — Are found in nearly all parts of the earth — Man helped to scatter them — How the compost worm lives — How the orchard worm lives — Habits of both compost and orchard worms — Diet of earthworms — How one man made a mistake in feeding earthworms — Nature's scheme — Man can improve upon Nature

As we have already discussed, the burrowing earthworm of our time is an animal that evolved from similar animals which once lived exclusively in the waters of the earth. While the terrestrial earthworms differ greatly from their marine relations of today, there are, many features and characteristics in both that are relatively alike. It is on these likenesses that science bases its contention that the earthworm evolved from its marine prototype.

Earthworms abound in practically every geological section of this planet. The exceptions to this rule are the extreme northern and southern latitudes where extended cold periods do not allow for the existence of this branch of invertebrate animals. But in torrid and temperate zones, some one thousand species of earthworms live, prosper and procreate.

The dense, humid jungles near and around the equator give us the largest specimens of the earthworm. These are undoubtedly

the direct antecedents of all terrestrial worms that have spread from one end of the earth to the other.

Assuming that the first progenitors of our present-day earthworm began near the equator, it is puzzling how they have become so widespread between the two frigid zones of the earth's surface.

This is satisfactorily explained by the realization that many species of earthworms peregrinate—they travel and migrate extensively. Some species are known to scale and cross high mountain ranges, though such migration probably required many hundreds of years.

Man, too, has undoubtedly, though unknowingly, aided in transporting earthworms from one hemisphere to another. This has been accomplished through the movement of trees and plants in whose roots worms, or their eggs, have been hidden.

It is quite possible that the early species of terrestrial worms were habitués of soil rich in organic matter or humus. It is also quite possible that these earthworms lived exclusively on the diet supplied them through humus and that the common brandling, or compost worm, is an evolutionary product of them.

In the early works regarding the life and habits of the earthworm, we find no references to the compost worm. All references to earthworms lead us to believe that early students of this branch of zoology, though they examined and studied the digestive organs of their subiects, failed to discover or to realize, or failed to describe, how easily the earthworm becomes a slave to its environment.

The compost worm demonstrates this slaveship admirably. As its name implies, it is found exclusively in manure compost piles, or in soil heavily laden with decayed animal matter. Tests have proved that in such fertilized soil the compost worm will become extinct if fresh manure is not repeatedly added.

To understand the peculiar dietary demand of the earthworm is vitally important for anyone interested in the habits and life of the earthworm. Without this knowledge, any attempt to domesticate

the earthworm for fertilizing purposes will be fruitless.

The compost-raised earthworm cannot absorb nourishment from soil which does not contain decayed animal matter. Because of this, any transplantation to ordinary soil would be fatal. Likewise, an attempt to transplant an orchard worm to a compost pile will result in its death.

Strangely enough, if the eggs of the compost worm are gathered and placed in a rich soil minus decayed animal matter, a large percentage will hatch and prosper. While the first offspring may not be high in quality, either in size or health, they will eventually become accustomed to their environment. Each following generation will show a decided improvement. It can be concluded from this premise that the brandling or compost worm is a distinct specie of earthworm.

The brandling, or compost worm, is almost one-third smaller than the common orchard or rainworm. But being of the same family, its head band and rings are identical, except that they are more emphasized.

The compost worm seldom burrows deeply beneath the surface. This is probably due to the fact that soil fertilized with decayed animal matter seldom goes deeper than eight to twelve inches. And, since it is from this organic substance the brandling gets its food supply, it remains within that depth.

Another characteristic of the compost worm is the fact that it does not throw its castings above the surface. Because it is a much fatter worm than the orchard worm, it can release its excretions behind it without fear of packing the tunnel through which it has eaten its way.

These conclusions have been reached after more than a decade of close scrutiny of the habits of the earthworm. The reader may prove these facts to his own satisfaction, and there is considerable evidence available to further substantiate these conclusions.

Like every other animal, the earthworm receives certain dietary necessities from what it eats. If the soil it lives in does not contain these life-giving essentials, the worm suffers. Such deficiency in

quality of food will ultimately cause death.

All earthworms eat raw and cooked meat, seldom anything putrid. They like fats, nuts, milk—in short, anything and everything that enriches the soil.

The digestive fluid of the earthworm is of the same chemical nature as the pancreatic secretion in higher animals. This accounts for the worm's ability to digest meats and fats as well as starches and sugars.

To illustrate the manner in which the dietary habits of the earthworm are governed by their environment, the following actual story is worthy of consideration here.

A California orchardist developed a culture bed of 50,000 breeding prolific earthworms. A later chapter is dedicated to their history and development.

He had been instructed how to properly feed his earthworms, but discovered that he could procure beef suet at an invitingly low price.

Believing that he could revolutionize his system of feeding, the orchardist began to place small pieces of suet in his culture trays. Slowly, he increased the amount until eventually suet became the worms' complete menu.

This method of feeding reduced the labor in tending to them, but the day of reckoning was not far distant.

When he was ready to harvest his crop of egg capsules, he discovered that the breeders had failed to breed. What few eggs there were contained no live germs.

He thought to place the obviously sterile worms within some of his trees. The worms' digestive organs had adapted to an all-animal fat diet by slow degrees. They could not adjust to an organic diet in time to prevent starving to death—which they did in a short time.

Similar experiences are on record, and the lessons learned have led us to the logical conclusion that the soil should be impregnated, not with young or mature worms, but with their eggs.

By this method, tests have proved that when the worms are

hatched in the environment in which they are intended to work, they will adapt to its food.

From this brief description of the dietary habits of the earthworm, we come face to face with natural laws reminding us that Nature constantly works blindly. She adheres to only one rule—the continuation of her various species—and is not interested in improving individuals of any of her species.

This fact has long since been accepted by man.

One should not be considered egotistical for claiming that he can improve upon Nature. Every stock farm and nursery disproves the once accepted statement, "You can't improve upon Nature." Our finest horses, cattle, dogs and other domesticated animals and fowls, as well as many trees, plants and vegetables, are the result of man's persistent and intelligent efforts to improve what Nature has given.

If these man-bred animals, trees and plants are not carefully cared for and properly mated by man, they will eventually become atavistic.

They will revert to their ancestral type—a type far inferior to the product evolved by man's intelligence.

Therefore, we should accept the earthworm as an important part of nature—as our friend, a natural friend that should be cultivated, developed and domesticated. By encouraging the earthworm to do its part, we will benefit.

"The possibilities of thought training are infinite, its consequence eternal, and yet few take the pains to direct their thinking into channels that will do them good, but instead leave it all to chance."
—Marden.

Lesson 3

Habits of the Newly Developed Earthworm

Why Nature's earthworm will not function — How the newly developed, prolific hybrid earthworm was developed — New earthworm does not form mounds on lawns or golf course — Leaves its casting under the surface near the root zones — Characteristics of the new worm — Retaining all favorable characteristics of both compost and orchard worm — Has no unfortunate characteristics

Science has admittedly known and appreciated the work of the earthworm for well over half a century. Many farmers, orchardists and gardeners have realized that in soil in which earthworms lived, plant and vegetable life prospered.

There are scattered instances where farmers fertilized land with decayed animal matter hauled from stables. They attempted to transplant the compost-bred earthworms. These attempts have been recorded, but, no known sincere effort was ever made to discover why the earthworms perished when moved.

Consistent experiments and research work showed that earthworms are as much in need of the food on which they were raised as fish are in need of water. It was found that compost-bred

earthworms demanded decayed animal matter; those raised in soil containing decayed vegetable matter demanded humus.

The author's first efforts to develop a satisfactory cross-bred earthworm were made in 1927. Selected specimens of earthworms found in various sections of the United States were studied, bred and interbred.

While engaged in landscape artistry, the author made observations of the brandling. It was shown that the brandling possessed many favorable qualities that could make crossbreeding very advantageous.

Chief among these favorable qualities was the fact that the brandling never deposited its excretions above the surface of the soil. This has two very important advantages.

First, no mounds are formed on the surface of the soil. Such little bumps cause lawns and golf courses to become uneven, sometimes unsightly, and, in the case of a golf course, ill-suited for the enthusiast of mountain billiards.

Second, all its castings are left under the surface of the soil near the root zones. The roots of plants and vegetables have easier access to the chemical and mineral elements pulverized by the earthworm's digestive tract.

Early experiments with the brandling showed that it appeared completely content in a tray, box or can. As long as it was well supplied with food, it was a prolific breeder.

Another characteristic of the brandling was its habit of living close to the surface of the soil, seldom going below six inches. Such a burrowing earthworm will cultivate the soil only around the upper roots of the plants and vegetables. While this may produce satisfactory results for some plant life, the author's desire was to develop an earthworm that would penetrate deeper into the soil.

Search for a promising earthworm to mate with the brandling produced no satisfactory results until a variety of orchard worm was found while matured trees were being transplanted.

This worm was large, and apparently spent much of its time deep in the ground, often down to ten and twelve feet.

A number of these worms were procured, carefully fed and studied. Observations showed that they burrowed as deep in the experimental trays, boxes and cans as they could get.

This type of orchard worm seemed to be an ideal medium for experimentation in the hope of producing a fertile cross between it and the brandling. Healthy specimens of both were selected.

These were placed in a special soil mixture, approximately one-third soil, one-third vegetable humus and one-third decayed animal matter. Such a composition of inorganic contains all (and theoretically more) of the vital elements necessary for plant life. These elements, however, are not always available to the roots of plants, as was explained in the introduction to this work.

Henry Drummond (1851-1897), an English philosopher and writer, pointed out that:

> "The inorganic or the mineral world is absolutely cut off from the plant or animal world... No change of substance, no modification of environment, no form of energy, no chemistry, no electricity, no evolution of any kind can ever endow a single atom of the mineral world with the attribute of life. Only by the dipping down into this dead world of some living form (Drummond obviously referred to the roots of plants, and we may safely add earthworms) can those dead atoms be gifted with the properties of vitality. Without this contact with life they remain fixed in the inorganic sphere forever."

Some form of life, either plant roots or earthworms, must bridge the gap between inorganic and organic (or living) matter, before the inorganic matter becomes available to plant life.

In the course of time, the worms having copulated, the egg capsules were extricated from the soil and placed in a separate container. When these hatched and grew to near-maturity, the weaker and less promising were culled out.

During the first six months, about a thousand cross-breeds which had been selected as breeders were mating and producing fertile eggs.

While this experiment seems to be the personification of simplicity, it should be realized that a full five years were consumed in these experiments. However, the results obtained in orchards, nurseries, gardens and poultry houses have proved that this quintet of years was worth every discouraging set-back. These set-backs were too numerous to be listed here. It is enough to say that there were times when Nature appeared to be stubbornly antagonizing all plans, figures and calculations.

I call this cross between the orchard and compost worm *Soilution*. Its chief features are:

1. A prolific breeder.
2. A free animal, no longer a slave to one environment.
3. Its castings never form objectionable mounds above the surface of the soil.
4. It is not an extensive traveler or migratory.
5. It makes exceptionally good fish bait, for it is lively and lives for many hours when impaled on a fish hook.

Lesson 4

Potential Markets for Earthworms

Know your business — Unsound to enter any business without knowledge of it — Fishermen are possible customers for earthworm breeders — Types of worm best suited for fishermen — The orchardist needs the services of the earthworm farmer — Orchardist is best customer for earthworm culture bed — Farmers are potential earthworm buyers — Poultrymen can save money with earthworm culture beds — One poultryman's opinion — The home gardener is always interested in beautifying his garden — Earthworms as garden beautifiers

In discussing the potential markets for *Soilution* earthworms it is important to deal with facts and not become lost or confused in a maze of over-enthusiastic statements, over-zealous predictions. Neither should we imagine that overnight wealth awaits everyone who would enter this new development of a natural resource. It has been active on this planet long before man himself arrived.

That there is a wide and varied market for active, prolific earthworms is a fact too obvious to question. But these markets cannot be attained by a mere snap of the fingers. Financial security may also be assured, but certainly not by any magic power concealed in or about the culturing of worms for commercial use.

It is economically unsound for any individual to enter any type

of business without at least a working knowledge of, or experience in, the business he or she selects. This economic rule, though undoubtedly it has its exceptions, is founded on sound logic and clear reasoning. It is the basic reason why beginning earthworm farmers should start on a small scale.

It should be kept in mind that the amateur earthworm farmer must thoroughly sell himself on the virtue of the earthworm. To accomplish this, he must study and understand the life and habits of his product. This may be accomplished by growing his own plants and vegetables as demonstrations with and without *Soilution* earthworm culture.

Once he has thoroughly sold himself, none can destroy the knowledge he has acquired nor the facts he has learned through personal experience, study and observation.

The tyro *Soilution* farmer must realize that it takes time for plants, shrubs and vegetables to show the benefits derived from the persistent and efficient work of the earthworm around the root zones.

Many forms of plant and vegetable life show a marked improvement in from 30 to 60 days after earthworms have been placed in the soil around their roots. In some instances, however, an entire growing season is required to prove the full merit of this type of culture.

And so, in justice to all persons contemplating entering this interesting and profitable line of work, it is hoped that readers of this book will not invest large sums of money in worm farms under the assumption that they will be financial lords overnight. To use a common expression, "it just isn't in the cards".

Assuming that the previous facts have been accepted, let us now turn our attention to the potential markets for selectively bred earthworms.

When the subject of earthworm farming is ushered into a conversation and discussed as a business, the ordinary person will usually recall the difficulty he experienced in finding worms in his garden the last time he planned a fishing trip.

Too many potential *Soilution* farmers imagine that every fisherman for miles around might be a good customer of one who could supply him with fat and active earthworms for bait. They fail to realize that many other potential earthworm farmers have thought the same way. The result is that competition becomes both keen and cutthroat during the annual fishing season. This results in a highly undesirable commercial and unsound economic condition.

Many years ago, the prevailing price of earthworm fish bait was one dollar for a six ounce can containing from 40 to 60 mature worms. The depression, plus absurd competition, brought the price tumbling down.

Competition was so keen in Denver, Colorado, that an earthworm price war resulted in six ounce cans being retailed for five cents.

The price of a can of earthworm bait in 1937 in California ranged from 30 to 50 cents for a can containing not less than fifty mature worms.

However, there is a pleasant and encouraging side to this type of unrestrained competition. Inefficient earthworm farmers are forced from the field, and men employing ethical business principles remain.

These are the men who thoroughly understand the remark of Phil D. Armour, of meat packing fame, who often said, "Any fool can compete, but it takes intelligence to organize and produce a better article."

When the smoke of the Denver price cutting war had cleared away, a lone worm farmer remained in the field. He had refused to reduce his prices, because he contended he had a better earthworm for fishermen.

Being a fisherman himself, the Denver man knew he could catch more fish with a small, active worm than he could with lifeless sections of large worms. This man's belief has been frequently substantiated by tests carried on by both amateur and expert fishermen, in soft and hard water, in lakes, rivers and

gurgling streams.

The *Soilution* earthworm, properly fed and properly placed on the hook, will live and remain active for many hours. In various practical tests, *Soilution* has competed with other types of earthworms, as well as with amputated pieces of earthworms.

It is apparent that the entrance to this particular market for *Soilution* earthworms should be carefully planned and thoroughly examined before making a decision. This suggestion is especially sound if the prospective bait-worm farmer contemplates gambling on the necessary investment required.

The progressive poultryman and game bird producer are promising prospects for *Soilution* culture beds. Both, particularly the poultryman, are rapidly learning the value of properly fed earthworms as an aid to better poultry and better eggs.

An example of the interest shown in worm culture beds by modern progressive poultrymen is emphasized by the following, extracted from a personal letter to the author late in 1937:

> "Six years ago I knew very little about the poultry and fruit business. Today I own a flock of 1,500 splendid birds and have been exhibiting at many of the poultry shows throughout the West during the past three years, and I believe I have garnered my share of blue ribbons. Incidentally, my fruit tops the market and I give the lowly burrowing earthworm credit for much of my success.
>
> In educating the public in the value of selectively bred earthworms under control, you are doing a commendable and highly educational work—a work that should prove beneficial and profitable to all progressive people who depend on the soil for their living."

This poultryman had a *Soilution* culture bed for five years. His records show, and they are substantiated by similar tests made by other poultrymen, that a laying hen will consume from five to seven *Soilution* earthworms daily. This amount seems to be the limit of both her capacity and her appetite for them.

Similar tests on ducks produced startlingly different records. One small flock of carefully watched growing ducks consumed a gallon of earthworms daily and repeatedly quacked for more.

At this point the reader may ask why, if earthworms aid in producing better hens and therefore better eggs, poultrymen have not turned in greater numbers to the operation of earthworm culture beds.

This question deserves more than passing attention here. There are two very sound answers.

First, many individuals have entered the poultry business with the false assumption that all that was necessary to do was to use whatever feed the feed store operator sold or recommended. In the past, starting in the crazy twenties, hundreds of thousands of Easterners and Middle Westerners were encouraged to trek to California and enter the poultry business.

From 1920 to the year of the crash, a countless number of otherwise sane persons proved susceptible to the poultry raising bug in the southern portion of the Golden State. A vast majority of these individuals knew no more about poultry raising and breeding than an Amazonian native knows about a full dress suit.

The most many of these would-be poultry raisers contributed to the industry was a number of discouragingly black pages in their own personal book of experience. Many of them found that their dream of fortune became a nightmare of misfortune.

In a lesser degree, these conditions prevail in various sections of the United States and emphasize what has been said in the third paragraph of this chapter.

There is a second reason why so many poultrymen are laboring long hours and using feeding methods that should be classed as belonging to the horse and buggy age. It is the fact that many poultrymen, in many sections of the United States, are indebted to the feed man. These men dare not change their system of feeding their flocks for fear of reprisals from the feed man.

This is a discouraging situation, undoubtedly due to our nationally strained economic system. What hope there is for these

men, what exit there is from their present position, are subjects more in keeping with a book on political philosophy or economic reform than for this volume.

The free-from-debt-to-the-feed-store poultryman is at liberty to purchase his poultry necessities, at liberty to operate his business, without being forced to abide by semi-dictatorial orders from outsiders. This man has left behind him the former methods of more or less haphazard feeding and has gone forward.

Through the assistance of the earthworm, the progressive poultry man can produce eggs for less than ten cents a dozen—a surprisingly low figure. In addition, he can increase the productive longevity of his birds and reduce the mortality rate of his pullets—a rate that has exceeded 50 percent in the state of California, according to reputable reports.

Since a single laying hen will consume about 2,000 breeding worms annually, the poultryman must operate a fairly large sized culture bed.

This is why the progressive poultryman may be considered by earthworm farmers as a very good potential customer.

The truck farmer, the suburbanite with a small vegetable garden, the nurseryman, the home gardener and the orchardist—all of these are potential buyers of properly bred, properly raised and properly fed earthworms.

Of this group, the one most in need of the earthworm as a natural cultivator and fertilizer is the orchardist. Then the rest in this order: the truck farmer, the small vegetable gardener, the nurseryman and the home gardener.

To state that an orchardist can reduce his overhead 50 percent by impregnating his soil with earthworms, may sound absurd. The following facts, carefully examined, checked and re-checked, should cause the most cynical person to realize that the immortal Charles Darwin did not exaggerate when he said that the earthworm is one of the world's most important animals.

Late in 1937, the following article appeared in the *Valley News*, Montrose, California:

"Near Redlands, California, is an orange grove that people come miles to observe. It demonstrates a unique natural method of orchard culture.

This 40 year old grove stands out among its neighbors in a way that even a layman can see. The foliage is thicker, a richer green, even at the top where others of its age show thin foliage and bare twigs. The trees are well filled with fruit and records show that they produce crops just as outstanding as their appearance. But the truly remarkable thing about this grove is the fact that these results are obtained with less labor, less water, and less fertilizer than is used by any of the neighbors.

The present owner took possession 17 years ago. Since that date, no plow, harrow or cultivator of any kind has been allowed in the grove. Weeds have been eliminated by hand labor. At first this caused extra expense; but since no weed is allowed to go to seed, a few hours labor once a month is now all that is needed.

The absence of mechanical cultivation is the first puzzle which this grove presents to horticulturists, for the necessity of soil conditioning has long been recognized. Actually this need has not been ignored here, but the owner depends, not on machinery, but on the world's finest and most efficient plow, the lowly earthworm. He has created conditions which are favorable to earthworms and in response they have multiplied until they are more numerous than in other groves. Their network of burrows has aerated the soil far more effectively and much deeper than mere surface cultivation could hope to do. At the same time, the feeder rootlets, which in an orange tree are very near the surface, are left undamaged, and therefore ready to absorb a maximum of food.

Even more puzzling to the orthodox grower is the fact that this grove thrives on less than 50 percent of the water required by others. The answer once more is explained by the burrowing habits of the earthworms. They prefer the cooler soil under the

trees and dig most of their burrows there, with very few out in the sunny spots. During irrigation; a large proportion of the water enters the soil through these burrows, with the result that most of it goes under the trees where the roots can use it, while much less than usual is wasted out beyond the root zone.

But the fact about the grove which seems hardest of all to comprehend is its fine health in spite of what seems to be a very inadequate fertilization plan: a little synthetic nitrate occasionally, nothing else in 17 years. Once again the earthworms furnish the answer, this time by their digestive processes. Earthworms depend for food on dead organic matter, leaves, old roots, etc. Through digestion these substances are changed in character so that they are highly soluble and when ejected are immediately available as plant food. A close examination of litter under the trees reveals thousands of leaves which have been completely consumed except for a delicate skeleton composed of their veins. The worms have put this material back into the soil, for reuse by the trees. Without them, it would be a very long time before the same material would become available for plant food.

The earthworm's gizzard triturates large quantities of soil which the earthworm takes into its body for two purposes — one to make his burrow by eating his way in; the other to obtain from his food all the essential elements necessary to produce fertile eggs.

New surfaces are thus exposed to the dissolving action of the irrigating water, and plant food elements are released which would otherwise remain locked up inside the grains of soil. Couple this with the fact that earthworms work to a depth of 6 or 8 feet, constantly bringing new dirt from these levels to the surface, and it can easily be understood how trees can thrive for a long period without the addition of new feed elements to the soil.

Earthworms are nature's own means of soil building and conditioning. No orchard or garden

> can do its best without them. There are many kinds, some much more effective than others, and the study of their use and culture will repay anyone who grows fruit and flowers."

The article concerns fine, cultivated fruit trees, and the reader might consider them so developed that they respond easily and quickly to such experiments. The antecedents of these trees have been more or less pampered by orchardists for many generations. Man, in his desire to force them to bear more and more fruit, has grafted and pruned and fertilized and sprayed. The fact remains that they have not responded to earthworm culture more easily or rapidly than the woody perennial trees growing wild on mountains and in forests.

Seedling pine trees have been impregnated with *Soilution* for the Forestry Service in the Sierra Madre Forest Reserve. Each treated tree is clearly marked and identified. The pines treated have grown in two years to a height usually requiring five years to reach.

On March 23, 1937, a wet, heavy snow blanketed the region. Many four-year-old pines, whose soil was not treated with earthworms, were almost carried to the ground by the weight of the snow upon their branches.

On the same day, other pines which had been supplied with the elements Nature intended them to have, stood perfectly straight. These necessary elements were made available to the roots of the pines through the pulverizing action of the earthworms.

An ambitious earthworm farmer may very easily demonstrate the ability of the earthworm as a cultivator, triturator, chemist and distributor. He may do this on his own premises and for the interest of any visitors seeking to improve the quality and quantity of their gardens, orchards, farms or truck patches.

For any thoroughly interested individuals, the farmer can offer to place demonstrations on their properties. Then, they can see for themselves how the earthworm improves plants.

Controlling Production

There is a method of controlling egg production of *Soilution* earthworms which makes it possible to have a crop every month in the year. This information is given only to people who wish to go into the business commercially.

The Earthworm

Little brown earthworm under the sod,
A trusted worker in Nature's plan,
Fulfilling his destiny, obeying his God,
Living his life as a friend of man.

East, where the Nile flows down from the hills
Covering the sun-baked thirsty soil,
An important place in the scheme he fills,
Bringing new life by his humble toil.

West, where the pioneer follows the plow,
Turning the sod to the sun and rain,
This little brown brother is doing his bit
To nourish the roots of the growing grain.

North, where the snow lies still and white
And the blustering wind blows cold and chill,
When the spring thaw comes you will find him at work
And October's Harvest can go to the mill.

South, where cattle roam Argentine's plains,
And grass grows tall 'neath the summer sun,
This busy fellow is doing his best
To make "two blades grow in the place of one".

— K.J. McCreedy

Part 2

Introduction

Every living thing, be it a tender blade of grass or a giant oak, an infinitesimal germ or a human being, has one point in common with every other living thing—it must eat.

And, though eating is as commonplace to human beings as breathing, most of us dig our own premature graves with our teeth. If our teeth haven't given out before the grave is ready to receive the remains of a badly mismanaged and mistreated body.

In the light of present-day science and the ease with which knowledge is acquired, one is forced to stand agape at the general apathy the public maintains in matters pertaining to food.

We need not go beyond our own circles of friends and acquaintances to have this fact brought to our attention. Who among us doesn't know of an overweight woman who greedily devours every dish before her, especially those containing sweets and starches? Or a thin, sickly woman who pecks and nibbles at what is placed before her?

Overeating and undereating bring premature destruction to countless thousands of individuals annually. Out of these two, the undereater is a subject with whom we might well sympathize. Usually, this type of individual is putty in the hands of all kinds of food faddists, new idea dietitians and their ilk.

Someone long ago passed out the misinformation that the human body is a machine. Ever since that unfortunate moment, faddists and charlatans have hooked their financially profitable ideas to this false idea, and have "gone to town with it".

Fundamentally, the human body is no more like a machine than modern printing resembles the crudest of prehistoric methods of record keeping.

The human body, as Alexis Carrel clearly explains in his remarkable work *Man, the Unknown*, originates in a single cell and grows into a series of cells. These ultimately become the manifold unity of a living, breathing individual.

A machine is brought into being by an entirely opposite method. First, instead of one small unit—the single cell that is man's beginning—there are hundreds of small parts. When properly assembled and fitted into their designated positions, these make one complete unit, ready to function as its designer planned.

Feeding living organisms—plant or animal, poultry or man—should not be looked upon in the same light as one considers fueling one's automobile. In the latter case, gasoline, lubricating oil and water are required in all but a few air-cooled motors. The gasoline is the actual "food", with oil and water playing their roles of lubricating and cooling the mechanism so that the gasoline will generate power, or, to fit the analogy, life.

Living things demand more than one, two or three essentials to continue to live. The living organism is a highly complicated unit, with each component part requiring definite types of foods or fuel.

This volume is primarily designed to assist poultry raisers and breeders in developing a sound, more economical system of producing better eggs at a lower cost, thus, producing better, healthier poultry. It is also the hope of this volume to explain food values which may be applied by human beings to their advantage.

The writer does not accept the Freudian theory that each individual's life is controlled by his or her sex glands. He does accept the scientific and biological fact that within the sex glands of all living things are, by Nature, the chief chemical and mineral elements necessary to procreate.

And so, from this premise, I approach a subject previously neglected.

Lesson 1

What is Food?

Various names for food — Alexis Carrel, Nobel Prize winner, quoted — Devitalized foods — White flour — Refined sugar — Pasteurized milk — We need a better Pure Foods and Drug Act — How children suffer from improper foods — Potency of procreative glands in animals and plants — How religion has bred ignorance on this subject — What are vital food energies? — Errors poultrymen make in feeding their flocks

For the purpose of blazing a straight trail to the goal of *Part 2*—better eggs and poultry at revolutionary low cost—it is helpful to consider food as nourishment for plant and animal life, including man. In a general sense, everything animals eat, and plants absorb through their roots, is food. In a more strict sense, food is any solid matter taken into the systems of plants or animals which serves to build up physical structure.

A food may be extremely pleasing to the eye, smell and taste, yet have no more food value than a toothpick. Much of this deception was generated in commercial and industrial interests who were selfishly seeking financial gain rather than preparing and marketing food stuffs with high nutritional content. While these commercial and industrial movements were heralded as being for the common good, the benefits derived by the public are, at best, debatable.

We will use these three staple foods—bread, sugar and milk—to bring light to this fact.

Alexis Carrel tells us in *Man, the Unknown*:

> "Our life is influenced in a large measure by commercial advertising. Such publicity is undertaken only in the interest of the advertisers and not of the consumers. For example, the public has been made to believe that white bread is better than brown. Then, flour has been bolted more and more thoroughly and thus deprived of its most useful components. Such treatment permits its preservation for longer periods and facilitates the making of bread. The millers and the bakers earn more money. The consumers eat an inferior product, believing it to be a superior one. And in the countries where bread is the principal food, the population degenerates. Enormous amounts of money are spent for publicity. As a result, large quantities of alimentary and pharmaceutical products, at the least useless, and often harmful, are thought to be necessary for civilized man. In this manner the greediness of individuals, sufficiently shrewd to create a popular demand for the goods that they have for sale, plays a leading part in the modern world."

Dr. Carrel's analysis of the promotion of white bread may also be applied to the popularity of refined sugar and pasteurized milk.

In the case of sugar, many of the most important elements have been refined out of the raw material, giving us a devitalized product. We know that refined sugar "looks better" on the table than raw sugar; that it is easier to shovel from the sugar bowl to the coffee cup and that it keeps indefinitely in our cupboard. These things we know, but advertising and publicity has led us to imagine refined sugar superior to raw sugar.

Pasteurized milk is the third staple which modern advertising has tricked us into believing is superior to raw milk. Regardless of the fact that pasteurization completely destroys many of the vitally important elements in milk necessary to good health.

Summed up, white flour, refined sugar and pasteurized milk are

counterfeit foods passed off on a gullible and apathetic public.

A large percentage of our present day ills may rightly be traced to deficiencies in our food. Many of these deficiencies are traceable to the high-speed and high-production systems employed in modern plants concerned with the business of making, packing and canning food stuffs.

This is civilization. Perhaps the Oriental Sage was not far from the truth when he defined civilization as a deterrent to progress.

Every civilization has within itself a suicide germ. This germ is fed by collective and individual greed. It destroyed the Greek, the Chinese and the Roman civilizations, and, as we have seen in the introduction to this volume, it is gaining potency in America through the medium of monopolies. All about us on this whirling sphere, national civilizations are cracking and crumbling. American civilization is cracking—every reasoning person is cognizant of this. Will it crumble? That is a question only time will decide.

No race, no nation whose members are both physically and mentally deficient or deteriorating can stem the encroachment of racial or national destruction. And no race or nation can expect its members to increase their physical and mental development if it persists in permitting misinformation about food deficiencies to continue.

"But we have a Pure Food and Drug Act on our statute books in Washington," you say. Yes, there is such an Act, but it is as useless as a gunless submarine on the Mojave Desert. If this act were rewritten, sincerely rewritten for the benefit of you and me and our children and their children's children, every sack of flour, every bag of refined sugar and every bottle of pasteurized milk would something like this written on it, in large letters:

THIS IS A DEVITALIZED PRODUCT.
IT HAS VERY LITTLE FOOD VALUE.

But the mere mention of a truly sincere pure food and drug act sends shivers up and down the spines of the financially powerful

milling, refining and kindred industries. Those whose leaders commit the sin of omission by refraining from telling their customers the true facts about devitalized foods.

Dr. Carrel merely brushed the surface when he wrote that

> "...in the countries where bread is the principle food, the population degenerates."

The unnatural conditions that follow in the wake of a continued diet of devitalized foods are destined to take their toll in weaker physiques, duller mentalities and in human lives.

The current generation of children is probably suffering more from food deficiencies than the preceding generation. This is partly due to the fact that a large majority of American parents have been forced, through economic conditions, to buy cheap food, or food of which they receive quantity rather than quality.

Another important factor, perhaps the chief factor, is radio advertising. The popularity of radio has made of this medium an ideal outlet for the fancy and romantic, albeit questionable, phrases of advertising copy writers:

Eat Whitey's Wheat Wafers and become a football star.

Breakfast on Betty's Baked Barley Blocks and win a husband.

Drink more Pasteurized milk and lick your weights in wildcats.

Give the kiddies Carter's Coddled Candy Cakes
and watch how quickly they grow.

... and so on, *ad infinitum*.

Radio advertising is the height of psychological suggestion. Few are the radio fans capable of entering a drug or grocery store without leaving with a bag, package or bottle of a product their favorite radio performer says is "tops."

In the relatively pathological scramble for more business, manufacturers of food stuffs are permitted by an apparently disinterested government to flood the nation with devitalized foods for man and beast. Not a few of which are as valueless for nourishment as a rubber band.

This lack of necessary food elements in a growing child's diet results in the child actually gorging itself in an unconscious effort to obtain sufficient and proper nourishment. The stomach of such a child begins to distend, it is forced to distend in order to accommodate the unnatural and unreasonable amount of food it receives. In time, the child is never satisfied unless it has packed its unnaturally dilated alimentary canal until it feels, and actually is, full.

Though it is not generally known, the average American eats nearly five times more bulk than he needs. If this absurd condition continues, physiology text books in the years to come will refer to Americans as a mongrel breed of human beings noted for their Gargantuan stomachs. Certainly, this is not a complimentary prediction. Yet even today there are many stomachs distended to ten times their necessary size.

The consistent eating of dead or devitalized foods is quite probably responsible for the increasing number of sterile men and women in America under thirty years of age.

The procreative glands, being composed of the richest elements that have been transformed by the various organs of the body, cannot be supplied with those elements if they are not in the food consumed.

Continued dieting by motion picture actresses to remain slender to meet the exaggeration of size produced by the cinematic camera has not only injured their general health, but probably their procreative glands as well. When the body cannot receive sufficient elements from the food intake, it automatically turns to the procreative glands to supply the deficiency. This reservoir is eventually drained, resulting in a sterility that, more often than not, becomes chronic.

However, this reference does not mean that all normally-sized or obese women (or men) are fertile. Undue fat on the human frame does not denote health; usually it signifies the opposite. Fat-producing foods contain very insignificant amounts of the elements demanded by the procreative glands.

Except in instances where a physical abnormality is responsible, eating too much of the improper mixture of food may be rightly blamed for the supercargo of avoirdupois that is being hauled around by obese men and women.

However, human beings are not the only animals that gorge themselves. Many plants and domesticated animals glut. Not because it is their nature to do so, but because their diet is deficient in one or more elements necessary for good health.

All of this may appear to be a roundabout approach to our subject—poultry. Nevertheless, we shall presently observe that what has been said about food for human beings, aptly applies to food for all forms of life.

Let us now consider the difference between organic or live food and devitalized or dead (inorganic) food.

It is at this point that the classical bull is taken by the horns and a subject discussed that has been shunned by writers on food and food values—the unequaled nutritional value of the procreative germ as food.

Our subject must be approached gently, for religious thinking in the past warns us that sex, in any form, is more or less taboo.

But no matter what one's religious theories may be, the fact should be accepted that life begins with sex. All living things owe their humble origin to sex, regardless of the method Nature employs in planting the fertile, procreative germ.

This germ is infinitesimal. Yet, Nature has combined all—not one, or a few, or an incomplete group—but *all* the vital necessities which, when blended with its direct opposite, produces a human being, an ant, an elephant, an orchid.

The vital qualities that are in the germ-plasm are what our bodies need. We receive one type of them when we eat wheat that has not been devitalized. Such a food is a "live" or "organic" food. When we eat bolted wheat, most, if not all, of these vital qualities are missing. Bolting has destroyed them. Such food is "dead," or "devitalized." Its nutritional value is practically nil.

Fruits, berries, nuts and all grains, if not devitalized by

dehydration or cooking, are the quintessence of the richest elements from the mother plant, tree or bush.

However, these germ cells are not rich—some are even sterile—if the plants, like human beings, do not receive their necessary elements from their food, the soil.

The average person has no qualms about eating the germ cells of fruits, berries, nuts, grains and vegetables. Nor does he object to eating eggs, which, if fertile, contain procreative germs.

The genitals of domesticated male animals—those whose flesh we approve as edible—are both palatable and nourishing. Most persons balk at the mere thought of such a dish—a delicacy when properly prepared. They will eat a fertile egg without a quibble, but make a wry face if the above dish—colloquially known as 'lamb, sheep, pork fry," or "Rocky Mountain oyster"—is suggested.

Carnivorous animals in their wild state will gorge themselves, not on the flesh of their kill, but upon the vital organs. Instinct instructs them that they will get the most nourishing elements from these organs for their bodies.

Rodents in a wild state are not interested in eating the lifeless leaves of plants. They live almost exclusively on grains, kernels, berries and seeds.

Are we to assume from these natural facts that wild beasts and rodents have "more sense" than we? Certainly, if one considers present-day eating, we would not be far wrong to admit their superiority in the matter of eating what is nourishing and what is not nourishing food.

Poultrymen are committing a grievous error in feeding their flocks tons of devitalized foods annually. Within their grasp is enough vital food to bring them greater profits, more productive hens and more fertile eggs.

How this germ-food for poultry and game birds is acquired is the subject of the next chapter.

Lesson 2

The Germ Life and Better Poultry

"Acquired richness" explained — The parable of two chickens — Live food versus dead food — Bacteria, good and bad — Nature destroys so that she can build — Dr. William Shakespeare Baer, American physician, "discovers" curative powers of fly maggots — Medical profession fought him — Why we abhor the word maggots — How germs evolve — The bluebottle fly

This chapter deals with the second forward step toward better poultry through natural foods. We shall move along lines similar to those discussed in the preceding chapter.

This method of approach may appear unnecessary, but the writer has experience in these matters. There will be a short stop here to lay a foundation so the reader may have a better understanding of the method of producing healthier and more prolific poultry.

As we have already seen, the procreative cells of all animals and plants are extraordinarily rich in vital elements. Many other parts of edible animals and plants may be rich in food elements, but this richness is not necessarily native to the animal or plant. It is an acquired richness and comes from the food the animal or plant subsists upon during its life.

Here is an explanation of what is meant by "acquired richness":

Picture two chickens. One is penned up in an ordinary yard. The soil is dry and dusty. The food fed this chicken is one of any number of commercialized poultry feeds, most of which are devitalized. The other chicken is turned loose near the dairy. All day it scratches and pecks in the decomposed animal matter piled nearby. The owner of the second hen need spends no money for commercial feed.

The first chicken is suffering from food deficiency, whether its owner realizes it or not. The second chicken is enjoying a full life, replete with a balanced, natural ration of food from which its entire physical system draws potent nourishment.

How do we account for this? Simply by realizing the fact that the chicken pecking in the manure pile has been eating *live food*, the other, *dead food*.

That one of these foods is dead, the other alive, is easily demonstrated by taking a shovelful of each and planting it. The shovelful from the manure pile will, in due time, send up sprouts of grain, depending upon that eaten by the animal that dropped it. Not all live grain germs are destroyed by an animal's digestive system—not even in the dual systems of ruminants.

In comparison, the shovelful of dry soil, having no form of plant germ life, returns nothing for the effort expended in planting it.

The foregoing example brings us again to organic (living) and inorganic (lifeless) matter. Both the dry, dusty soil in the chicken yard and the pile of manure back of the dairy barn are scientifically classified as inorganic matter.

However, there is considerable life in manure. It contains millions and millions of bacteria, which, as everyone knows, are infinitesimal organisms. Bacteria are also known as microbes and germs.

At this point, the reader should accept the fact that there are beneficial as well as dangerous bacteria. Some of these, according to the germ theorists of the medical fraternity, are disease germs and will, if left alone, produce illness and death.

Probably man's greatest handicap in this so-called enlightened

age is not so much the general ignorance that is prevalent regarding Nature and her methods as it is the misinformation and misapplication of known facts. These are distorted by some "authorities" for their personal and collective financial gain.

That certain bacteria are destructive to animal and plant tissues is a fact—a natural fact. But Nature, in her own definitely evolutionary and omniscient way, has developed other bacteria to defeat the dangerous inroads of destructive bacteria. This is one form of the law of preservation. Were Nature to develop one bacterium, one small insignificantly-sized germ, without also developing an enemy to keep it under control, entire species of animals and plants would pass from this planet.

Once destruction appears in living matter, if Nature cannot combat it, she appears to hasten its ruin. The result is ultimate death. And even here, she does not stem her onward march to destruction. Decomposition is rapid in most instances of dead, once organic matter. Nature is anxious to prepare that matter for consumption by other living bodies.

The late Ambrose Bierce, the immortal San Franciscan, described 'edible' in his *Cynic's Dictionary* as

> "good to eat, and wholesome to digest, as a worm to a toad, a toad to a snake, a snake to a pig, a pig to a man, and a man to a worm."

(It is worth a parenthetical note here to say that only the lifeless remains of once living matter decays and decomposes rapidly. Inorganic matter, like rocks, for example, do decay and ultimately decompose, but the process is slow and drawn-out, lasting thousands of years. The reason for this is explained when we realize that Nature can put such inorganic matter to little use as food for her various species.)

Bacteria, good and bad, have their place and their function in the laws governing all living things.

These minute creatures are everywhere—in the air we breathe, the water we drink and the soil we plow. Without them, you and I would not be here. We—all living animals—feed, to a greater

or lesser degree, on plants. Plants in their turn, feed upon water, carbon dioxide and the nitrogens and other salts.

We know where plants receive their needed water and carbon dioxide. We should know that they receive their necessary nitrogenous salts from but one source—bacteria—and that bacteria, in their turn, receive their necessary nourishment from a few minerals.

In short, bacteria are the beginning of animation, of life. Beyond bacteria is inanimate matter, lifeless rocks and colloidal substances.

So we see that the chicken pecking in the manure pile has a veritable storehouse of living food, countless trillions of minute bacteria, rich in the necessary food values its feathered body demands.

In rich soil, too, soil moistened adequately with water, countless other trillions of bacteria exist. The eminent naturalist, David Starr Jordan, has pointed out that he has found over four million bacteria in one gram of such soil.

Let us now return to the procreative germ, the germ of life produced in healthy, mature animals and plants. This germ is the rudimentary element, the primary source of everything that lives, the earliest stage of an organism, the cause, origin, principle and prime mover of all life.

Though science has discovered many interesting and astonishing things about germs—both procreative and bacterial—there still remains much to be learned about these minute organisms. Many of these are so infinitesimal that they are barely visible under a strong, microscopic lens.

Until the World War period, the maggots or larvae of flies were considered as filthy and disease-bearing as any creature known to man.

It was the late William Shakespeare Baer, an American M.D. working with the French forces, who first came upon the bacteria-destroying ability of fly maggots.

Two *poilus* were brought to the hospital where Dr. Baer was

stationed. They had lain for a week behind bushes, minus food and water. Each had a thigh horribly smashed, and the shattered bones protruded through the skins, and the wounds extended into each abdomen. According to all medical science of the day, both men should have been dead. Yet they were alive, conscious and hungry.

When Dr. Baer examined these men, he found their wounds a teeming mass of fly maggots. When he cleaned them away, the flesh and bones were bright and clear and healthy. There was not the slightest trace of a disease-bearing germ anywhere in the wounds. The fly maggots had destroyed them.

With the passing of years, Dr. Baer experimented with fly maggots. He worked on the theory that they were more efficient workmen than the finest surgeon with all his modern sanitary methods, sterilized instruments, operations and amputations.

Naturally, such a theory did not set well with certain members of his profession, but Dr. Baer didn't care. He thought of the two French soldiers, of how they lived when they should have been dead, and of the hundreds of children suffering from *osteomyelitis*—a pernicious rotting of bone marrow and bone structure.

In the Children's Hospital in Baltimore, of which he was the head, Dr. Baer bred fly maggots and placed them in the openings he made in the afflicted flesh. Ignoring objections made by the medical community, he carried on his work. He fought strenuously against those who had an aversion to anything new or revolutionary. Things that should be common knowledge.

And Dr. Baer cured those children—or, rather, the fly maggots cured them!

Though the story of Dr. Baer's work and struggle deserves considerable space, there is, unfortunately, no room for it here. It is enough to conclude that fly maggots are used extensively today by the medical community as destroyers of many disease germs. All of this proves the point desired—that many destructive germs can be destroyed if other friendly germs are given a chance to work for us.

For centuries, the medical profession has been teaching the general public to scowl at the mention of the word "maggot." And so, the average person has generated both an aversion and a hate for the word. One may actually question if its use in polite society is permissible. To the average mind, "maggot" is synonymous with filth, offal, danger and disease.

And now the medical profession finds itself in the ludicrous position of expounding something it has up to now warned against.

Appreciating the general dislike for the word "maggot," it will appear from now on in this work under its other name: "larva."

Thousands of germs never pass the germ stage. That is to say, certain germs live and die as germs. Others go through varied forms of evolution. All germs begin life as single cells. Those that are destined by Nature to evolve into a higher plane, join another germ.

Nature employs a variety of systems to perform the task of impregnation. In higher animals, including man, the single male and female germs blend and produce the embryo. The evolution of the single cell germ is made in one remarkable step.

In certain insects, the fleshfly, for example, the change from the procreative germ to the living, ultimate fly is performed by a circuitous route.

The fleshfly, of which the bluebottle is probably the best known, lays her eggs, many hundreds of them, in decayed or decaying animal flesh. In from two to three days, these eggs hatch into small, white worms or larvae. In time, a sort of shell or cocoon forms around the worm. It enters a dormant period, during which the worm is being slowly transformed into a fly. Upon the completion of the transformation, a full-grown bluebottle appears.

It is the intermediate stage that spans the egg to the fly with which we are especially concerned, and in a later chapter it will be referred to again at some length.

Thought, immaterial though it may be, is the matrix that shapes the issues of life. The mind has been active in all fields during this fruitful century, but it is to science we must look for the thoughts that have shaped all thinking.