WILHELM REICH

The Bion Experiments

On the Origin of Life

Translated from the German
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PART TWO *The Dialectical-Materialistic Interpretation*

Love, work, and knowledge are the wellsprings of our life. They should also govern it.

WILHELM REICH

Preface

It is with some trepidation that I make known these experimental findings on the origin of vegetative life. It is not that I am worried about the correctness or accuracy of the data given, even though here or there an insignificant error or an awkward phrase may have crept in. All the findings described in this comprehensive, yet not definitive, report were confirmed hundreds of times. I have omitted any observations that were not verified and I have gone to great lengths to describe the method as precisely as possible, so that it can be tested by others. If the instructions are followed more or less correctly, it is impossible to miss the basic phenomena such as the vesicular disintegration of matter upon swelling or the culturability of the bions. I fully realize that the same findings are open to other interpretations than my own. For this reason I have carefully separated the factual report in Part One from the interpretation in Part Two.

I am concerned that I might be criticized as immodest for drawing the conclusions that I do from these experiments. I stayed within the bounds laid down by eighteen years of clinical work on the functionally diseased organism and ten years of intensive study of the relevant biological and physiological literature. The sections on colloids and on the dialectical-materialistic method of research were finished many years ago but lay unpublished in my desk drawer. They represented attempts to link my practical experience as a psychotherapist with my general biological studies. I had become directly aware of the connection with psychoanalytic knowledge, on the basis of my orgasm

theory, when in 1926 I was asked to review a book by Fr. Kraus on the pathology of personality (*Syzygiologie*) for a scientific journal.

I did not suspect that ten years later I would be given the opportunity to verify natural philosophical assumptions and the dialectical-materialistic method in such a way, although I knew, of course, that the orgasm theory touched on the "life problem." What I submit here is not a random discovery, but a development over a period of years of work on the problem of the autonomic function. Step by step the fundamentals of a theory of biogenesis, which had to be worked out in full, were revealed. I have to admit that the facts I discovered seemed incredible at first. But fact after fact came to light and each one confirmed the picture that I had already formed from clinical studies of the life function and its disturbances. By the time I published "Experimentelle Ergebnisse über die elektrische Funktion von Sexualität und Angst" in 1937, the results of the bion culture experiments were already available. Now that I have decided to publish them, I have at my disposal additional data in a related area which confirm and represent a continuation of these experiments.

The techniques which I used in the experiments do not differ from those customarily employed for bacteriological sterilization. However, the arrangement of the experiments as well as the methods of interpretation and the conclusions that are drawn differ considerably from the norm. The experiments were all based on the fundamental formula which I had discovered in the course of my research in the field of sexuality. The analytic method follows the laws of dialectical materialism. Marx had added the element of materialism to the Hegelian dialectic, but the method was first used in a natural scientific context by Engels; it then found a new application in psychology and the process of sexuality. The principles of the method became more refined and new ways of obtaining knowledge were revealed as, for example, in the "dialectical-materialistic law of development." From Freud I adopted the hypothetical equation

of life impulses and sexual impulses. Once I had succeeded in refuting his theory of the death instinct and in developing my orgasm theory, I was able to proceed to experimental biology. The experimental proof of the identity of the sexual energy process and the life energy process is thus simultaneously a confirmation of Freud's hypothesis.

At this point I would like to express my warmest thanks to Professor Roger du Teil for the incomparable friendship he has given me throughout our collaboration. Whatever effect his efforts to draw the attention of biologists and bacteriologists to this work may have, his active participation in the experiments has become an organic part of the entire series of studies. This is clear from the text that follows.

I am also aware that the experimental solution of the question of spontaneous generation satisfies many needs throughout the scientific world. Similarly, I know that I will have to face some sharp opposition. However, the back and forth of argument and counter-argument constitutes the very essence of scientific work. What is more, every objection leads to progress if the fundamental problem is correctly grasped.

My work "Der dialektische Materialismus in der Lebensforschung" (*Zeitschr. f. pol. Psych. u. Sexök.*, No. 3, Vol. IV, 1937) gives a historical analysis of the development of the problem. It also points out the connections that exist between this problem and sociological questions. I have left for future publication the details of many studies and also the analysis of related questions.

I am particularly grateful to Professor Harald Schjeldrup for having made possible and actively assisted in carrying out the initial physiological electrical experiments at the psychological institute of his university. Without his assistance, even in general matters, I would have had to overcome many more problems.

Extraordinary material difficulties were encountered in setting up the laboratory operations. The Rockefeller Foundation in Paris refused its support. It would not have been possible to

conduct the experiments at an official establishment engaged in other work, and I would never have been able to manage alone. Therefore, I should like to take this opportunity to thank publicly all those who made the undertaking possible in the face of difficult odds. Above all, my thanks are due to my friend Sigurd Hoel, whose advice often kept me from losing faith in my ability to see the project through. I am also grateful to our friend Dr. Odd Havrevold, who set up the laboratory in which the experiments were conducted, provided general practical assistance, and solicited contributions. In addition, my thanks go to those who helped me carry out the bacteriological, cinephotomicrographic, and physical-chemical work and who, through their initiative and drive, helped me overcome many obstacles. Much more would have gone wrong without the active material support given the institute by my colleagues in the field of character analysis; they helped me to set up and maintain the entire operation: Dr. Lotte Liebeck, Dr. Nic. Hoel, Dr. Ola Raknes, Dr. Tage Philipson, Dr. Leunbach, Ellen Siersted.

However, these specialists were not able to provide large sums of money and their efforts alone would not have been sufficient. (The equipment for the biological laboratory alone cost approximately 60,000 Norwegian kroner. At the present time it costs approximately 2,000 Norwegian kroner per month to operate the laboratory.) My work was decisively aided by large contributions from Mr. Lars Christensen (Oslo), Mr. Rolf Stenersen (Oslo), and Constance Tracey (London).

The overall project was greatly assisted by the administrative staff and in particular by my secretary Gertrud Brandt, who tirelessly and efficiently maintained order in my wide range of activities. The head of our publishing house, Mr. Harry Pröll, supervised the production of the book with great care and diligence.

The Institute was founded by Norwegians. The extraordinary hospitality of the Norwegian people has provided a fertile background and basis for my work, full responsibility for which

is mine; Norway is a country that has been able, by and large, to keep the emotional malaise of the world at bay.

THE ESSENTIAL LABORATORY EQUIPMENT (Figures 1–11)

The complicated experiments designed to determine the microbiological and electrical properties of the substances, as well as of the various types of bions, required equipment which was adapted to specific purposes or, in some cases, which had to be specially created.

The microscope

At present our institute possesses three large Reichert "Z" microscopes and one Leitz research microscope. With the Reichert microscopes it is easy to achieve a magnification of up to 3750×, as a result of the inclined binocular tubes, which increase the normal magnification by 50 percent. When a special Leitz 150× apochromat lens is used in conjunction with a 25× compensating ocular and the inclined binocular tubes, it is possible to achieve a magnification of up to 4500×, but with great difficulty. Dark field examinations were carried out at approximately 300× to check for motion and at 1200× to assess the coarse structure and the type of motion. Furthermore, observations were conducted at approximately 3000× to determine the fine structure of the organisms and the vibrations inside their body mass visible only at this magnification. In order to assess the internal movements reliably, a dark field condenser, manufactured by Reichert of Vienna, was also used. With this device it is possible to make observations in a dark field at approximately 3000×.

This manipulation is very complicated and requires lengthy preparations. Many characteristic processes could be seen only by using the Reichert "Z" microscope. This microscope revealed phenomena which would certainly not have been visible using a straight single-tube instrument or even one with non-inclined

binocular tubes. *It is not really possible to verify the findings unless the same optics are used.*

Cinephotomicrographic apparatus

Each new process that was observed, if it proved to be typical, was immediately filmed. Two types of cameras were used. We had a CK Pan Film Camera, Kodak (F I, 9), which permitted a speed of eight frames per second; i.e., the motion was accelerated to twice normal speed. On the average, filming was done between magnifications of 300× and 1500×, using a single-tube microscope and fixing the camera lens directly above the ocular of the microscope. By means of a special device it was also possible to film structures which moved only slightly; in this case, a microscope with inclined binocular tubes was used at 2300× and the camera was mounted on one of the oculars.

The large Cine Kodak Special Camera (F I, 9), used for time-lapse photography of developmental processes, permits single exposures to be made; also, the light intensity and exposure speed can be adjusted very accurately.

Two time-lapse devices were used. One was an electric release control for the Cine Kodak Special manufactured by the Eastman Kodak Company. By switching various relays, one could accelerate the motion in the following order of magnitude:

4×	normal	speed	(4	frames	per	second)		
8×	”	”	(2	”	”	”	)	
16×	”	”	(1	frame	”	”	)	
32×	”	”	(1	”	every	2	seconds)	
48×	”	”	(1	”	”	3	”	)
64×	”	”	(1	”	”	4	”	)
80×	”	”	(1	”	”	5	”	)
96×	”	”	(1	”	”	6	”	)

In order to speed up the motion ninety-six times, one meter of film was exposed in thirteen minutes and twelve seconds. This apparatus was used for filming developmental processes and forms of motion which could still be seen at high magnification, although with some effort. For filming processes of develop-

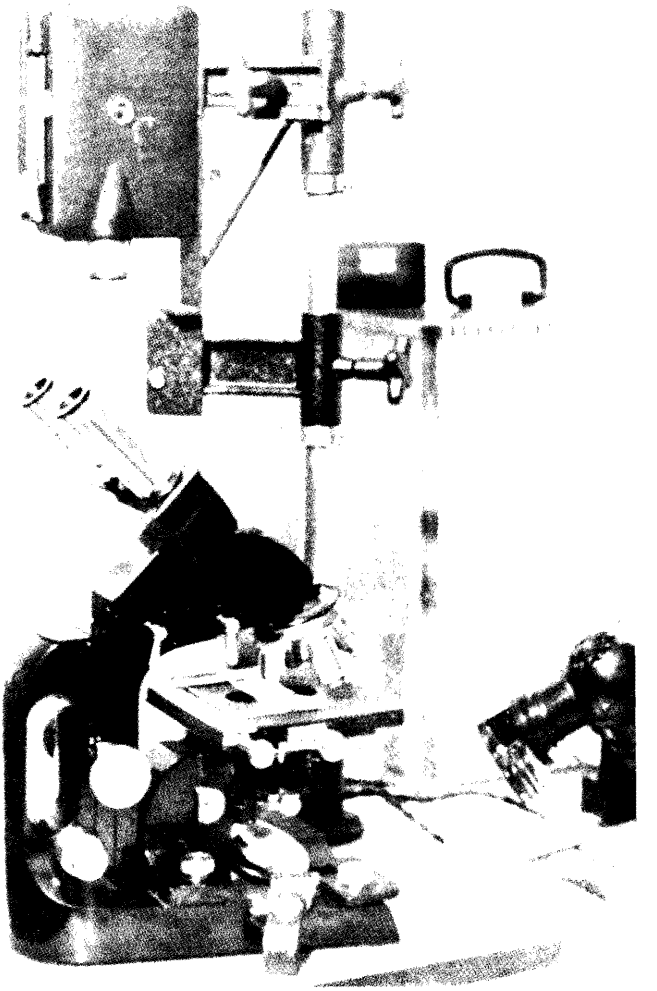

Figure 1. The large Reichert microscope for magnifications up to 4500×

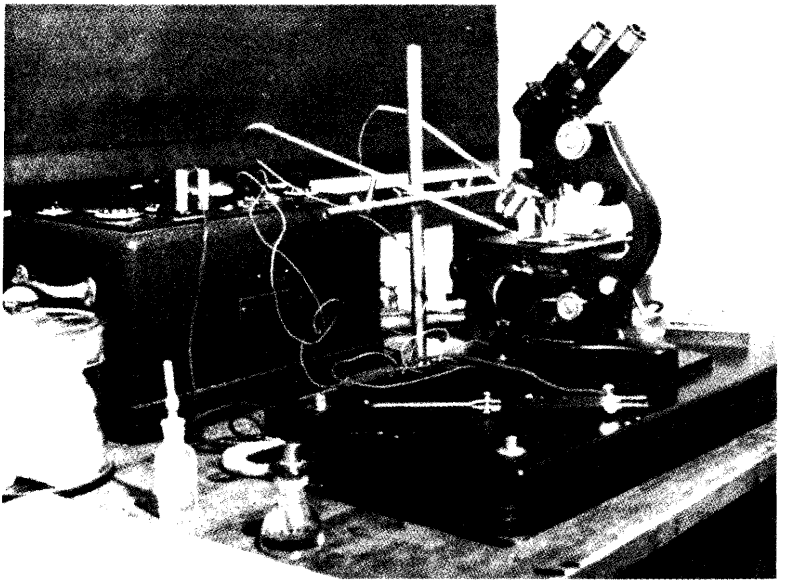

Figure 2. Apparatus for micro-electrical studies

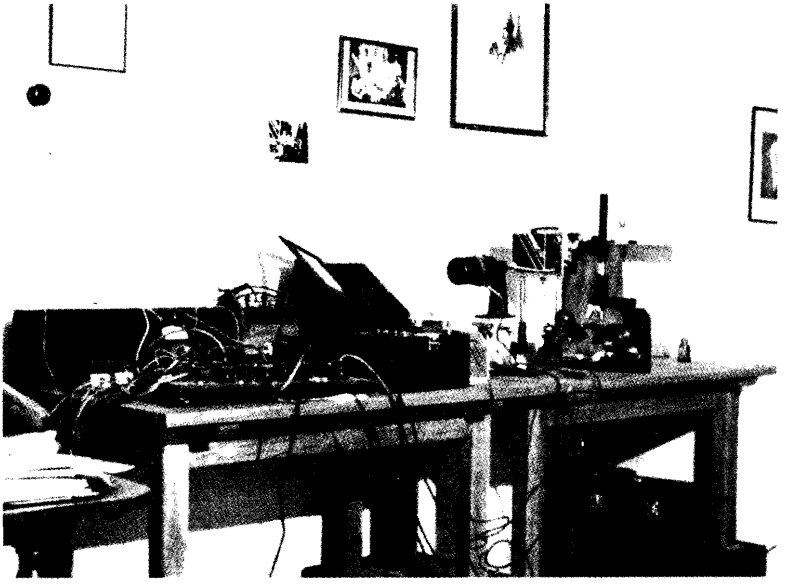

Figure 3. Cinephotomicrographic apparatus (for short and long-interval time-lapse filming)

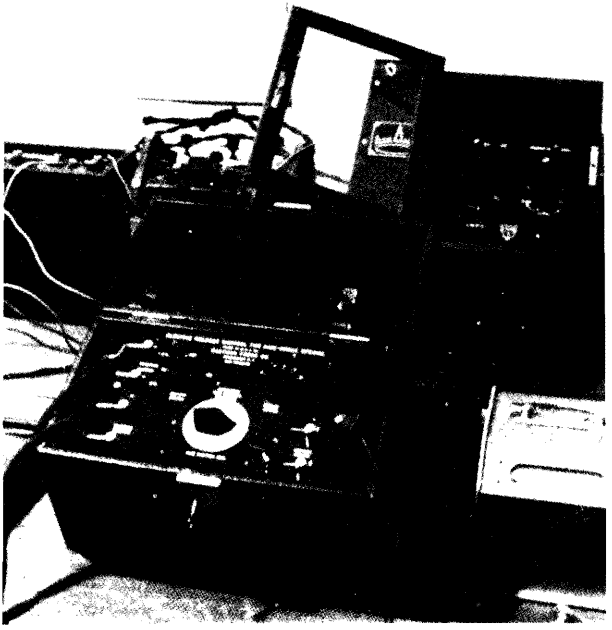

Figure 4. The two relay control units for the time-lapse filming

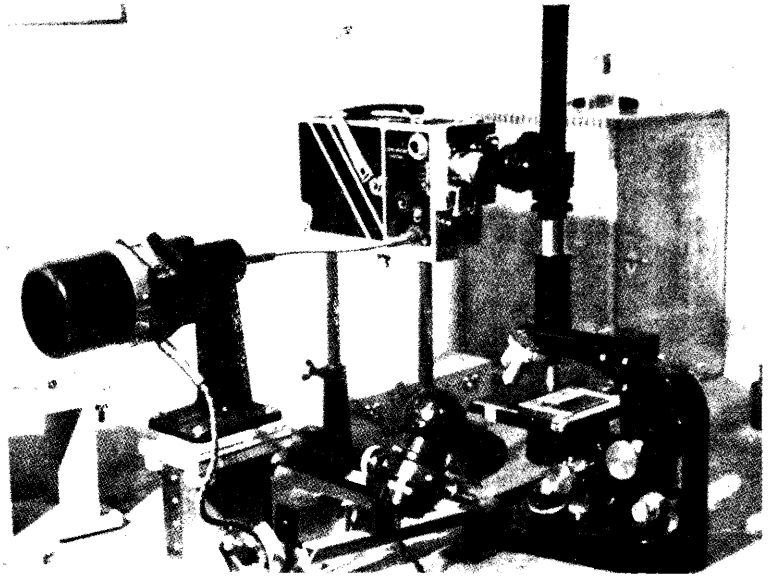

Figure 5. The cinephotomicrographic apparatus with motor for time-lapse filming

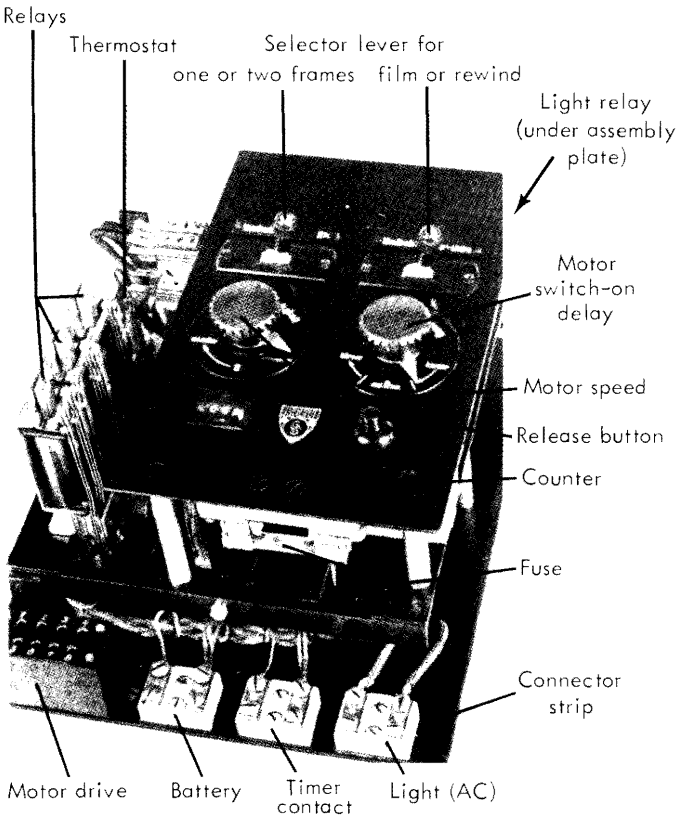

Figure 6. Relay control unit for long-interval time-lapse filming

Figure 7. Contact timer for setting time intervals

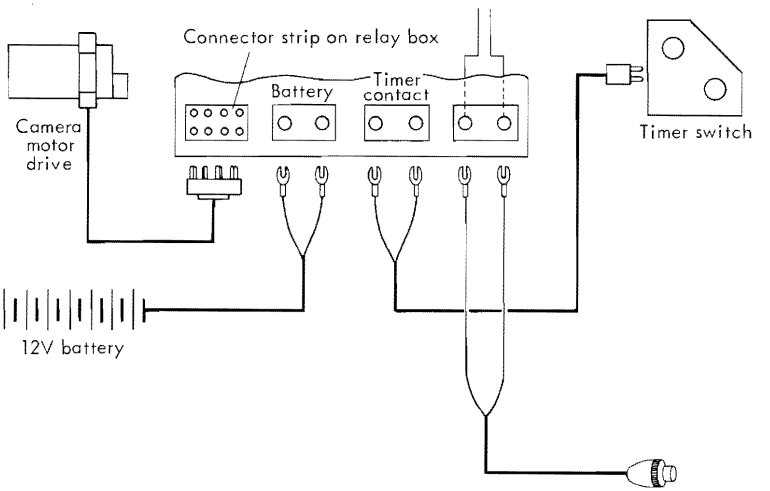

Figure 8. Switching circuit for the long-interval time-lapse apparatus

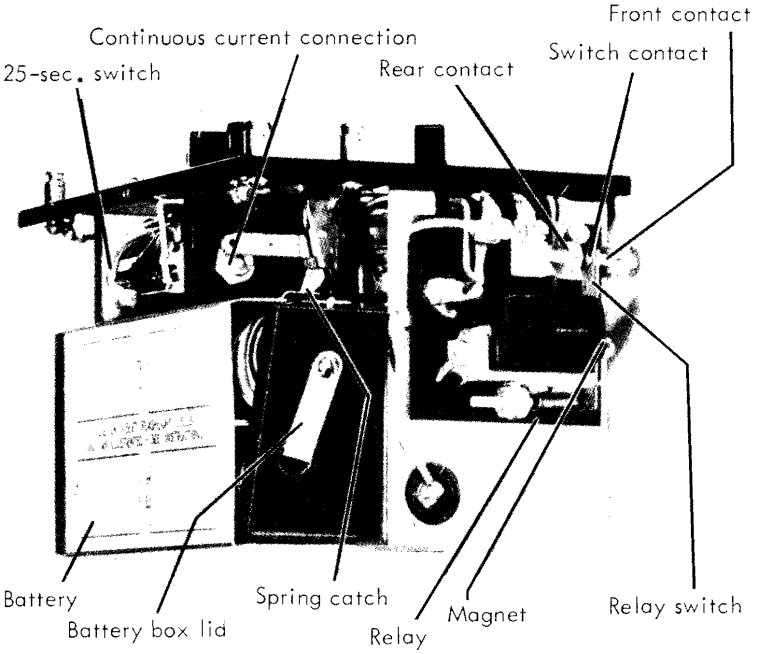

Figure 9. Short-interval time-lapse apparatus

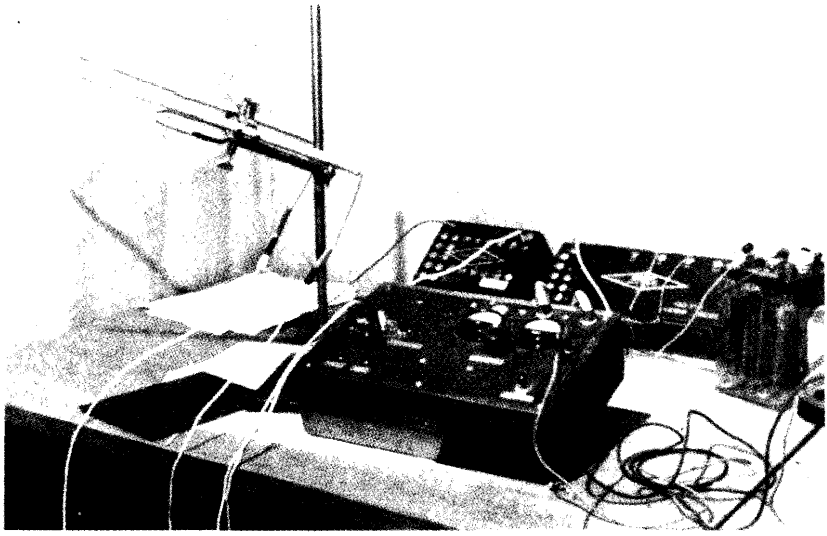

Figure 10. Three-tube amplifier and silver electrodes

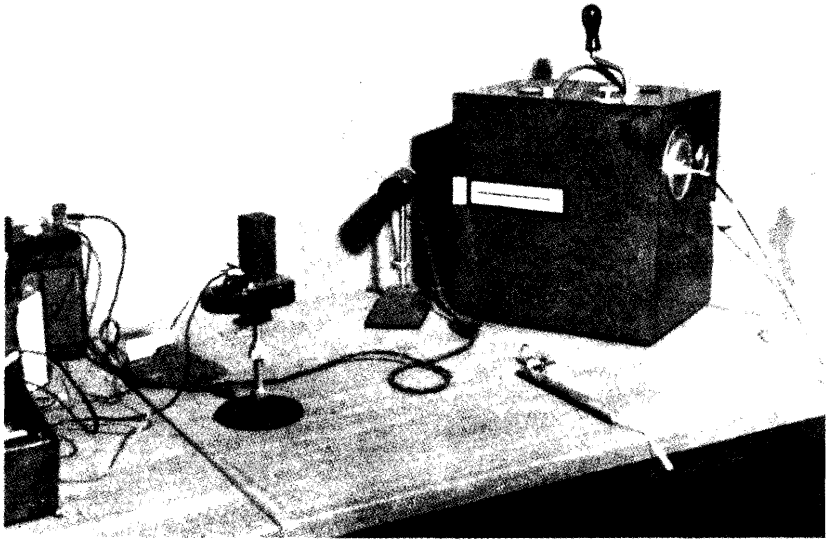

Figure 11. Oscilloscope, roll film apparatus, and non-polarizable screened electrode

ment and movement not directly observable, a time-lapse device manufactured by Askania (Berlin) was used. The system of switches and relays permitted the following speeds to be selected:

One	frame	every	15	seconds	(240×	normal	speed)
”	”	”	20	”	(320×	”	”)
”	”	”	30	”	(480×	”	”)
”	”	”	40	”	(640×	”	”)
”	”	”	minute		(960×	”	”)
”	”	”	5	minutes	(4800×	”	”)
”	”	”	10	”	(9600×	”	”)
”	”	”	15	”	(14400×	”	”)
”	”	”	20	”	(19200×	”	”)
”	”	”	30	”	(28800×	”	”)
”	”	”	40	”	(38400×	”	”)
”	”	”	hour		(57600×	”	”)
”	”	”	2	hours	(115200×	”	”)
”	”	”	5	”	(288000×	”	”)
”	”	”	10	”	(576000×	”	”)

In the last time adjustment in the above table, one meter of film was exposed in fifty-five days and nights. Time-lapse exposures were made at magnifications between about 300 and 1200×.

A specially constructed apparatus (see Fig. 2) was used for the micro-electrical studies. A solid round rod was mounted vertically on a sturdy base; a transverse rod was attached to this vertical rod in such a way that it could be moved. To this transverse rod two glass tubes were attached which could be moved in two directions and through which ran a copper wire. At one end a fine thin platinum wire protruded. The platinum wires were attached to eyes fixed on opposite sides of a trough-shaped container on a slide. This apparatus was connected with a pantostat manufactured by Siemens (Berlin) permitting exact measurements and metering of current down to 0.2 mA.

Later on, all the films were made with the aid of an optical adapter which permitted observations while the film was being exposed. The camera can be mounted over the ocular vertically

as well as horizontally. By the summer of 1937 we had prepared one complete film of preparation 8 (development of protozoa) and one complete film of preparation 6 (bion experiment); and one film was near completion: preparations 1, 2, and 3 (preliminary stages of life represented by swelling earth, coal, and soot). The laboratory also possessed all the equipment needed to develop the film.

The electrical potential was measured by an oscilloscope which was connected to a three-tube direct-current amplifier. This apparatus was manufactured by the University Instrument factory in Lund (Figs. 10 and 11).

A complete laboratory with autoclaves (sterilization at 120°C) and dry sterilizer (sterilization up to 190°C) was set up for the bacteriological investigations.

W.R.

October 1937

1

The Tension-Charge Formula

In this work I will describe my observations made during experiments in which inanimate matter was transformed into bacterial organisms. Let me begin by briefly outlining the theoretical basis for the experiments.

In the course of about fifteen years of clinical work, I came to recognize a formula for the function of the orgasm which was verified in subsequent experiments. * In vegetative life there is a process through which mechanical filling, or *tension*, leads to a build-up of *electrical charge;* this is followed by *electrical discharge*, which, in turn, culminates in *mechanical relaxation*. This phenomenon raised two questions:

1. Does this formula apply only to the function of the orgasm, or is it valid for all vegetative functions?

2. Since the orgasm is an elementary phenomenon of life, the formula expressing it should also be demonstrable in the most primitive biological functions; for instance, the vital functions of protozoa. The basic assumption, therefore, was that the orgasm formula is identical with the life formula. Initially, I was not very optimistic about finding proof of this assumption within a short time. It was quite fortuitous that I was able to solve the major part of the problem relatively quickly and with certainty.

In addition, my clinical and experimental experience had

* "Experimentelle Ergebnisse über die elektrische Funktion von Sexualität und Angst" (1937); "Der Urgegensatz des vegetativen Lebens" (1934); both published by the Sexpol-Verlag, Oslo.

raised a series of questions which guided the biological investigations. In the electrical experiments on sexual zones it had been discovered that the vegetative excitations are functionally identical with corresponding directions of flow of electrical current. The vegetative excitations proved to be functionally identical with primary vegetative movements which could basically be divided into two groups: the sensation of reaching out and well-being—i.e., *expansion*—corresponds to actual stretching, as illustrated by erection of the penis. On the other hand, anxiety and a feeling of unpleasure are identical with "retreat into the self"; i.e., with a *contraction* of the biological organism. In marine mollusks which I observed, the alternation between expansion and contraction was startlingly clear. The discharge of electrical energy during contractions of electric fish confirmed my assumption that sudden contraction is functionally identical with electrical discharge. Hence, I felt I could allow myself the mental leap in concluding that electrical charge at the periphery is functionally identical with expansion and a feeling of well-being, while electrical discharge at the periphery is identical with contraction and fright or anxiety. In expansion, to pursue my theory further, the distance between particles is increased by the process of swelling, a process which must be closely connected with the increase in electrical potential. In contraction, the distance between particles decreases as a result of shrinkage; thus, the tissues are more resistant and there is a drop in electrical potential; i.e., a discharge occurs. Logically, it should be possible to experience the physical electrical potential directly, in the form of a vegetative sensation of excitation.

Furthermore, about three years ago, in the course of my clinical work on muscularly hypertonic neurotics, I had discovered the *orgasm reflex*. After the hypertonicity had been eliminated, isolated vegetative contractions in various parts of the body combined to give a single total body reflex which I called orgasm reflex. This is the same phenomenon as the automatic vegetative convulsion that takes place at the climax of sexual gratification. I could only conclude that the autonomic nervous system expands and stretches when pleasure is experi-

enced and contracts in the case of fright. The unity of function of the total organism seemed decisive to me here; i.e., the amoeba lives on in the metazoan in the form of the contractile and expansile vegetative apparatus.

According to this view, the nerves of the organism no longer seemed to be the generators of the impulses, but instead were merely organized transmission paths for the vegetative impulses of the entire body. In the literature I found abundant evidence for the view that the ganglia of the vegetative nervous system function as storage batteries and that the muscles act as discharge apparatuses which produce motion. The body fluid, which in the case of human beings accounts for about 80 percent of the total body weight, must be regarded as the most important medium for the propagation of electrical excitations.

The basic functions of living creatures—namely, expansion and contraction—dominate all life, but they themselves are composed of a complicated combination of individual physical functions. I will go into detail later about the facts revealed by colloid chemistry. At this point I wish to restrict myself to a brief description of an overall system of uniformity, not only within the realm of organic life, but also between organic and inorganic functions. As I have already stated, these were just conjectures which arose out of a large series of clinical and experimental studies.

The biological direction "toward the world" represented in expansion, and the opposite direction "away from the world," "retreat into the self," represented in contraction, seemed to me to have a primitive model in the mechanical act of expansion of a pig's bladder. If a pig's bladder is filled with air it stretches mechanically. The surface becomes tense and strives to return to its original state; the process is similar to that of a taut spring. The internal pressure exerted by the air prevents the restoration of the original state. There are now three possibilities:

> The internal pressure is *less* than the surface tension, so the bladder can be pumped up still further without bursting.

The internal pressure is *equal* to the surface tension, so the bladder assumes a stable spherical shape.

The internal pressure can finally *exceed* the surface tension, so that the bladder bursts.

In the living realm an increase in internal pressure leads to a contraction, as in the urinary bladder, or to constriction and division, as in a cell.

In electricity, I was struck by the antithesis of charge and discharge. In the inorganic sphere mechanical tension and relaxation and electrical charge and discharge are separate functions. The organic or living sphere, however, is governed by a specific combination of the two physical functions: tension → charge → discharge → relaxation. This is the formula for biological functioning.

In chemistry there are certain substances which have a swelling (i.e., tensioning) and a shrinking (i.e., relaxing) effect. When potassium chloride and lecithin act on the tissue, the surface tension increases as a result of the swelling, i.e., expanding effect. When calcium and cholesterin act on the tissue, the surface tension is reduced as a result of the shrinking, i.e., contracting effect.

For the understanding of organic functioning, it is obviously significant that tension and relaxation, swelling and shrinking, stretching and drawing together, charge and discharge, etc., are all combined together in *one* system in the functions of the parasympathetic and sympathetic. In a special study entitled *The Basic Antithesis of Vegetative Life* (*Der Urgegensatz des vegetativen Lebens*, 1934), I described this situation, drawing on the experimental results achieved by other authors. Potassium has the same effect as lecithin, lecithin as the vagus (parasympathetic), and the vagus, finally, as pleasurable excitation, swelling, turgor, increased surface tension, and, as was recently shown, electrical charge. In contrast, calcium, cholesterin, the sympathetic nervous system and unpleasure or anxiety form a func-

tional unit characterized by shrinking, contraction, discharge, and reduction in surface tension.

The following is a comparative table which I prepared four years ago:

Vegetative Group	*General Effect on Tissues*	*Central Effect*	*Peripheral Effect*
Sympathetic Calcium (group) Adrenalin Cholesterin H-ions	Reduction of surface tension Dehydration Striated musculature: flaccid or spastic Reduction of electrical excitability Increase of oxygen consumption Increase of blood pressure	Systolic Heart musculature is stimulated	Vasoconstriction Intestinal peristalsis decreased
Parasympathetic Potassium (group) Cholin Lecithin OH-ions	Increase of surface tension Hydration Muscles: increased tonicity Increase of electrical excitability Decrease of oxygen consumption Decrease of blood pressure	Diastolic Heart musculature relaxed	Vasodilatation Intestinal peristalsis increased

That which biologists and, in particular, metaphysical biologists have so far referred to as "organizing intention," "entelechy," etc., seemed to me to be contained in the jump from individual physical functions to a *combination* of these functions which governs the process of life. Thus, it was possible to replace metaphysical biologistic interpretations by the dialectical-materialistic formulation of life processes (see Chapter 8, Part Two).

The uniformity of organic functioning is regulated by the tension-charge process in both the individual organs and the

total organism. The uniformity between inorganic and organic processes is contained in the functions of expansion-contraction and charge-discharge. *The difference between organic and inorganic arises from the specific combination of functions in the organic which otherwise occur singly in inorganic substances.*

From these premises, I proceeded to carry out the biological experiments described in the following chapters.