

PART VIII

THE EIGHTH PRINCIPLE; "BIO-DIALECTIC"

CHAP. I. What is "Bio-dialectic"?

(1) The wavy and spiral tendency of life phenomena

It was fifty years ago that I noticed and set about to study the periodicity-waviness or rhythm-asymmetry, reversibility, and repetition of forms, structures, phenomena or functions, and movement which can be widely seen in all living things including human beings, and since then I have been studying the facts and theory of the spiral form or spiral movement of organisms. As for the particulars, such as the motive for which I began to study this matter, the details in which I have collected the materials on it and studied it, and the results which I have obtained from my studies on it, I should like you to see my complete works "CHISHIMA'S REVOLUTIONAL THEORY ON THE BIOLOGICAL & MEDICAL SCIENCES", vol. 7, 1972.

It is a matter of course that the seven above-mentioned principles of this author which may get down to the grass roots of biological sciences should essentially belong to the category of "bio-dialectic". And also it is natural that the complete works of this author in ten volumes, about over thousand pages, "CHISHIMA'S REVOLUTIONAL THEORY ON THE ORTHODOX BIOLOGICAL & MEDICAL SCIENCES, should be consistently written on "bio-dialectic" or bio-dialectical methodology.

Therefore, the reason this author advances a new theory against the orthodox biological and medical sciences is that this author believes firmly that the theory corresponds both to the facts and to this philosophical thinking or scientific methodology.

(2) The Wave-spiral tendency of life phenomena-"Bio-dialectic"

There are many facts that show "the waviness and spirality of life phenomena" of which this author gives a detailed account in the seventh volume of his complete works, and then those facts may prove biologically that spirality is inevitably revealed when the asymmetry and periodicity or repetition of the forms, phenomena or functions, and movement of life change dynamically.

It is "bio-dialectic" that tries to represent such life phenomena philosophically.

"Bio-dialectic" is a new dialectic that tries to sublimate, or *aufheben*, idealistic dialectic and dialectical materialism which are opposed to each other, and then to unify both mind and body in a body. And also "bio-dialectic" may be of great use in sublimating, or *aufheben*, vitalism or teleology and mechanism, spiritualism and materialism, and Orientalism and Occidentalism, or Oriental medicine and Occidental medicine, which have been opposed to each other in their views of life.

(3) True philosophy and the orthodox biological scientists

It is regrettable that there are very few scientists in the domain of the orthodox biology who have, or try to have, true philosophy or true scientific methodology.

Leonardo da Vinci (1452-1519) says, "He who is a slave to practice without theory is just like a pilot who tries to steer a ship without a chart and a compass, and then he cannot tell where he should go. Therefore, practice should be built on true theory." This may be a stern warning to the scientists who have no true philosophy or no true way of looking at things, and then are apt to make a big mistake.

Dr. K. Hashida and Dr. T. Terada, who are the prominent scientists in Japan, say with one voice, "There are very few scientists in Japan who have true philosophy." Looking out over the world of modern science, this may be true not only of Japanese scientists but also of foreign scientists.

And also considering the trend of modern science widely, it seems that many of the natural scientists in biology, medical science, and other bio-sciences as

well as in physics and chemistry, conclude that philosophy is of no use for science, and then they adhere to formal logic that is static, immovable, and analytic, whether they do so consciously or unconsciously. Anyway, formal logic seems to be the only methodology that they can hold or believe firmly.

Some of the scientists in the Communist world abide by dialectical materialism, while recently many of the natural scientists in the Soviet Union also seem to approach a sort of formal logic that is analytic and mechanistic.

What is science? It goes without saying that science is essentially to collect facts through observations and experiments, to arrange them, to explain and systematize them on true logic, and finally to lead them to a scientific law.

(4) Creativeness and scientists

Scientists should not be only workers, but they should be creative researchers.

And then they should be correct and logical in their thinking; otherwise they are liable to give a fact a twist, and sometimes they are liable to set up a theory against the facts. So it is important that in order to see the real aspects of things, we should wear colorless and transparent spectacles, or we should try to see things with the eye of the spirit and with the eyes of philosophers' or poets. For, when we look at it through colored spectacles, the same thing appears as another quite different from it.

Therefore, this author thinks that scientists should not be only technical workers, but they should be creative researchers who have true philosophy and excellent insight.

(5) Information and scientists

Today, a vast number of scientific papers are published in the world every year. Even the papers on biological and medical sciences that are published every day are vast in number.

And some of those papers are contradictory to, and opposed to, each other. Therefore, it is one of the most important problems for modern scientists that they unify and systematize those papers through the true spectacles of science, or through true methodology. As matters now stand, some data are correctly explained, some are incorrectly explained, plenty of information is

scattered without being unified and systematized, and, as a result, the world of knowledge is getting more and more confused.

This author insists that it is one of the most important duties with which modern scientists should be charged that they try to criticize, select, and unify the results which many scientists have obtained from their years' studies with much difficulty through their correct spectacles, or through true methodology, and then they try to make the best of them for the welfare and health of mankind.

(6) The standard of scientific judgement; the necessity of philosophy

Which is better for scientific judgement, the orthodox theory or Chishima's new, revolutionary theory? What is the criterion, the eye of the spirit, that can tell which of the two is nearer to the facts?

The standard of scientific judgement—the standard of judging whether a principle or a law is correct or not—is always dependent upon whether the principle or the law corresponds completely to the facts or not. For, in science the fact is first, and the explanation the second.

Of course in order that we may see if the above-mentioned principles of this author are correct, it is the surest method that they are compared with the facts one by one carefully. But it is, as a matter of fact, extremely difficult that all people re-examine a theory, comparing it with the facts.

So we are obliged to judge whether the theory is correct or not without re-examining it and without comparing it with the facts. In this case, if we have only true thinking or true scientific methodology, we shall not be thrown into confusion, but we shall be able to judge exactly whether the theory is correct or not.

Therefore, it is necessary that we should know and understand what is the truest methodology in science.

(7) A comparison between formal logic and "bio-dialectic"
(wave and spiral tendency of life)

A comparison between formal logic and "bio-dialectic" will be given in the following comparative table. The former has been firmly believed by many of the scientists in the free countries, while the latter is newly advanced by this author.

Tab. 8-1

Comparison between Formal Logic and "Bio-dialectic"

Bio-dialectic - Criterion of new biology & medicine -	Formal Logic - Criterion of orthodox biology & medicine -
<p>(1) Dynamic, fluidic, . . . : All things move, develop, and change with the passage of time. - the vicissitudes of all things.</p> <p>(2) Importance of an intermediate portion or boundary area An intermediate portion between A and B or between black and white, is thought much of, while the principle of excluded middle is considered incorrect. - the problem included in the boundary, or <i>Grenzgebiet</i>(G) is the most important.</p>	<p>(1) Static, fixed, . . .</p> <p>(2) The principle of excluded middle: Things are sharply divided into A or B, and an intermediate portion between A and B is excluded as a general rule.</p>
<p>(3) Contradiction or Antagonism (opposition): All things involve contradiction or antagonism, and it is the driving force of progress and change. And all things repeat the following process: thesis → antithesis → synthesis → (New thesis) → antithesis → synthesis</p>	<p>(3) The principle of identity or the principle of contradiction: A is A, and then A is not non-A. Therefore, any contradiction or transitions from A to B are not allowed as a rule.</p>

(4) Conversion from quantity to quality is thought much of:
Change in quality is caused by the accumulation of quantity.

(5) Unification of idealistic dialectic & dialectical materialism:

Hegel laid emphasis on spirit than matter, while Marx & Engels emphasized more of matter, but this author thinks that both spirit and matter are indivisibly unified in a body. (The first to the fifth item described above are the main points of the so-called "dialectic".)

(6) Matter & energy, mind & body are indivisible:

In "bio-dialectic", matter & energy, mind & body are indivisibly unified in a body.

This expresses the fact that it is necessary that idealistic dialectic and dialectical materialism should be sublimated, developed, and unified in a new dialectic themselves.

Therefore, "bio-dialectic" may be called the truest view of life phenomena. - the unification of matter & mind.

And also "bio-dialectic" may be called "vital-mechanism" that tries to unify vitalism and mechanism.

Moreover, it is certain that the

(4) Conversion from quantity to quality is not thought much of.

(5) Non-dialectic:

Neither of the two dialectics is allowed.

(6) The understanding of the relationships between mind and body is imperfect:

Any of such sciences as physics, chemistry, biology, medicine, and agriculture, which assume mainly formal logic as methodology, is materialistic and mechanistic, so any of them is lacking in the understanding of the indivisibility of mind (energy), and body (matter), and then insufficient to understand organism as a whole.

third medicine will appear in the future that harmonizes Occidental medicine with Oriental one, as true medical science.

(7) Far-sighted, total, and synthetic:

It is essential to correct judgement that things should be, as a whole, looked at synthetically through the eye-glasses of wide space and long time.

The whole of a living body is not a simply total sum of part but more than a simple total sum of parts. Namely the whole newly acquires something that the part has not yet.

Therefore, the relation between analysis and synthesis is made much of. — wholeness & synthesis. We should try to avoid committing such a folly like a lot of blind men feeling a great elephant.

(8) The A. F. D. Process is made much of in explaining the genesis development, and evolution of life:

A. F. D. is the abbreviated word designated by me that capitalized the three words—Aggregation, Fusion, and Differentiation.

The process of degeneration, senility, decline, and decay is the reverse A. F. D. process. —

(7) Near-sighted, partial, and analytic:

The wholeness, or *Ganzheit*, of a living body is neglected or made little of, while only analysis is made much of.

(8) The A. F. D. Process is almost entirely neglected.

(9) Environment and heredity are equally made much of:

A continuous view of matter and energy is assumed.

The harmony of nature and man, men and men, "Ki" —mind, "Ketsu" — body and blood, and "Do"—movement — is thought much of, respectively.

Naturalness is held in esteem, and natural healing is taken as a remedy for disease. And then it is thought that the most essential treatment is to get rid of unnaturalness and disharmony.

— continuousness & harmony

(10) All is reversible:

It is open to question that the Second law of thermodynamics — the law of the increase of entropy — which is the fundamental law in modern physics is applied even to life phenomena without due consideration. But the principle of reversibility is considered true.

(11) The times, society, humanity, and conscience are taken into consideration:

It is a scientist that makes a scientific principle, but he is only a man. So he is naturally influenced by an era and society which he lives in. Because he is also affected by his own scientific attitude that he assum-

(9) Only heredity is made much of:

Only heredity is made much of, while environment is made little of.

A discontinuous view of a matter is assumed.

Unnaturalness is mistaken for naturalness, and symptomatic treatment is taken as a remedy for disease.

(10) Reversibility is denied:

The Second law of thermodynamics is applied even to life phenomena without due consideration.

(11) The times, society, humanity, and conscience are only slightly taken into consideration.

es, he is apt to misunderstand a theory, or to give it a twist.

Therefore, it is necessary that we should know, discern, and criticize a tendency that a theory is apt to be distorted from the weak points of human-thinking. And then considering the above weak points, we should judge whether a theory is right or wrong.

(12) Life phenomena should be understood as a rhythm and spiral movement.

In concluding, this author insists that true scientists should be always modest to the facts, and haughty to the authorities.

(12) Life phenomena are liable to be understood as a straight-line movement.

In the first to the fourth item of the twelve above-mentioned items, dialectic and formal logic are contrasted or compared with each other. It is a well-known fact that dialectical materialism is widely taken as the only scientific methodology in the Communist world, while formal logic is assumed in the free world including Japan, today. Therefore, the dispute on heredity between the United States and the Soviet Union, the East and the West, arises from this difference between both camps in methodology. However, the East and the West which are opposed to each other are, reversely, common in respect that both camps take materialism and mechanism.

In the sixth to the twelfth item, "bio-dialectic" is roughly explained. This author believes firmly that "bio-dialectic" is the only scientific thinking that sublimates, or *aufheben*, and unifies dialectic and formal logic, materialism and spiritualism, and then dialectical materialism and idealistic dialectic.

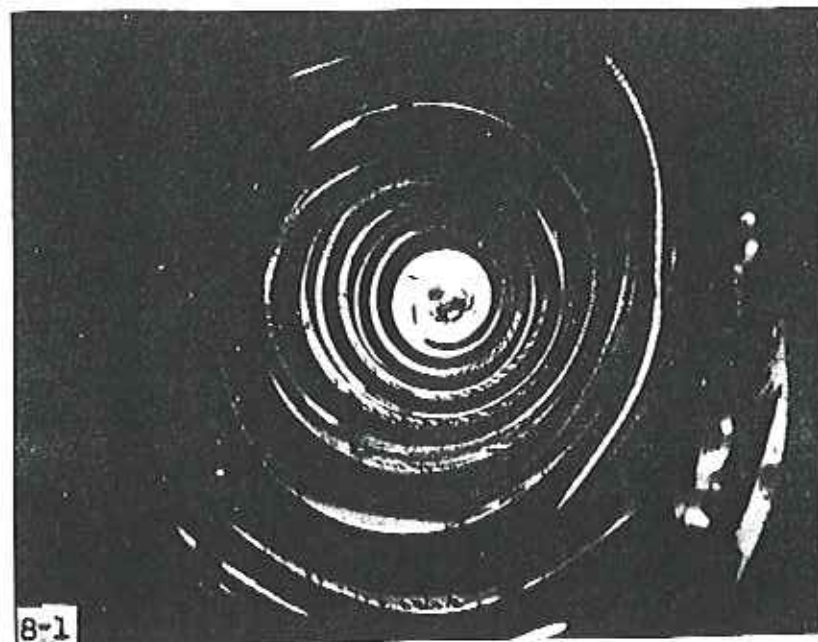


Fig. 8-1. Symbolic pattern of bio-dialectic.

Spiral crack appeared on the surface of the hen's egg albumen dried up. It implicitly suggests that life phenomena, and the evolutionary patterns of atoms, the cosmic world and living beings show the same tendency.

(8) The four types of thinking

As scientific methodology, there are, at present, the four types of thinking; that is, formal logic, idealistic dialectic, dialectical materialism, and "bio-dialectic" advanced by this author.

This author will give roughly his opinion of the four types of thinking in the following items.

(9) Criticism on a formal logical point of view

① Blind spots of the scientists adhering to formal logic

Those who adhere to a formal logical point of view are, generally, liable to look at things conclusively and immovably. In formal logic, the following principles are considered essential to it as stated above in Tab. 8-1.

(I) A is A, B is B — the principle of identity. (II) A is A, A is not non-A — the principle of contradiction. (III) Any neutral existence that is neither A nor B is not allowed as a general rule — the principle of excluded middle.

Perhaps, many of the people think that this way of looking at things is quite right, without due consideration. For they formally think that a man is a man, a woman is a woman, an erythrocyte is an erythrocyte, not a leucocyte, a germ cell is a germ cell, not a somatic cell. And it is conclusively thought in formal logic that germ cells such as ova or spermatozoa belong to the strain quite different from, or independent of, the strain of all somatic cells in the body excepting germ cells.

Indeed, this is the fundamental way of thinking in modern biology and medical science, but this author suggests that we should see that there is the bound-sphere, or *Grenzgebiet*, in which things are neither A nor B, but show a transforming phase from A into B or a grey-domain, or that there are many things in the natural world, especially in the biological world, which cannot be distinctly divided into A or B.

But it seems that many of the modern bio-scientists consciously neglect the bound-sphere in life phenomena which is vague and neutral or grey, and they take only the things which can be clearly divided into A or B, as the object of their studies.

The discrimination between animals and plants is impossible in the kingdom of the lower microorganisms. The boundary line between living things and lifeless things is also vague. There are transitional phases between men and women, male and female animals. For instance hermaphrodites can be often seen in the kingdom of the lower animals. The intermediate phase of blood corpuscles can be seen in the process of the differentiation of erythrocytes into leucocytes. The cells which seem to be at the intermediate stage between somatic cells and germ cells can be seen very often.

It is regrettable that many of the modern bio-scientists who abide by formal logic neglect the specific character of an organism that is dynamic, movable and changeable, and look at it statically, immovably, and unchangeably as shown in Tab. 8-1.

② A bound-sphere, or *Grenzgebiet*

Though the most important secret of life is covered up in the bound-sphere, many of the modern bio-scientists adhering to formal logic look entirely for the things which can be sharply divided into A or B, and try to neglect or avoid the things which are difficult to be clearly divided into A or B, or the bound-sphere in which things are at a transitional phase or a grey domain.

Therefore, it may not be said that they are not true to the facts.

③ Modern biological and medical sciences are based mainly on mechanism and materialism

Many of the modern biologists who adhere to formal logic try to explain and understand not only matter and the body but also life phenomena through the way of physical and chemical analysis only. But on the other hand, they are liable to make little of spirit or mind and mental energy.

Therefore, as matters now stand, it is not expected that good results will be obtained in medical treatment because a living body in which originally mind and body should be indivisibly unified in a organism is not correctly understood

(10) The unification of the three ways of thinking—
dialectical materialism, idealistic dialectic, and
formal logic

Dialectical materialism is superior to formal logic. Dialectical materialism and "bio-dialectic" are common to each other as stated above in the first to the fourth item. (See Tab. 8-1).

① All things change continuously with the passage of time,
—the vicissitude of all things—

All things change continuously. Especially, an organism is dynamic and changeable. In formal logic, things are looked at statically and immovably, while in dialectic they are looked at dynamically and movably.

Therefore, dialectic is right because things are looked at dynamically in it.

② All things involve contradiction or antagonism

All things involve contradiction or antagonism and it is the driving force of progress and development. Therefore, dialectic is right because all things repeat the process, "thesis → antithesis → synthesis," and develop, or evolve, themselves by these means.

③ Conversion from quantity to quality is allowed in dialectic, while
"the principle of excluded middle" in formal logic it is denied.

Accumulation of quantity brings about a qualitative change, while it is denied in the principle of excluded middle, formal logic. Therefore, dialectic is right because it corresponds entirely to the facts, or to the changes of the natural phenomena including life.

④ In dialectic contradiction or antagonism is regarded as the
driving force of change and development.

As stated above, dialectic is the only philosophy advocating that all things change continuously with the passage of time, repeating the following process—thesis → antithesis → synthesis. That is to say contradiction or antagonism

is the driving force of progress, development, and evolution. Therefore, it may be said that natural phenomena and life phenomena can be much better explained by dialectic than by formal logic.

⑤ Difference between dialectic materialism and "bio-dialectic"

Dialectic materialism and "bio-dialectic" are common to each other in the first to the fourth item as stated above, (Tab. 8-1) but both are rather different from each other in the following point :

The former explains that matter is prior to energy and mind, and both energy and mind are attributed to matter, while the latter explains that matter and energy, matter and mind are indivisibly unified in a body.

⑥ Hegel's idealistic dialectic is unfavourably criticized as an
inverted one by Marx & Engels.

It is true that Marx & Engels criticized Hegel's idealistic dialectic as an inverted one in their period in the 19th century, but it may be open to question whether or not their criticism is quite right in modern times—especially in the latter half of the 20th century. For, today, science—especially medical science and biology—is in an impasse in methodology, industry is prior to man, social contradiction is increasing in number, and as for medicine, it is yielding to commercialism, owing to the current of materialistic thought.

Therefore, it is necessary that we should take notice that the time is coming when dialectical materialism explaining that matter is prior to mind should be converted into a new dialectic, or "bio-dialectic", explaining that matter and mind originally should be indivisibly unified in a body. This new dialectic, or "bio-dialectic", corresponds completely to the principle of what is called "dialectic" explaining that the genesis, development, and evolution of things are caused by contradiction or antagonism they involve in themselves, and then they repeat the process, "thesis → antithesis → synthesis". If we adhere to dialectical materialism as dogmatically as ever, neglecting this new dialectic, we shall fall into self-contradiction that we deny dialectic itself because it explains that all things change continuously with the passage of time, and then we shall neglect the transition of times and the evolution of human spirit.

Dialectical materialism may be right in that it is dependent on dialectic

indeed, but it is doubtful as to whether it can completely explain all natural phenomena including life or not. For, since it is materialistic, dialectical materialism comes to terms with such scientific thought as is dependent on formal logic and with the current of materialistic thought by which industry and society are very much affected today.

It seems to be the main current of contemporary thought by which men are isolated from each other, and human life is made light of.

Therefore, this author insists that dialectical materialism explaining that matter is prior to mind should be inevitably converted into "bio-dialectic" explaining that originally matter and mind should be indivisibly unified in a body.

⑦ Many of the modern bio-scientists do not try to know and understand even dialectical materialism.

Many of the modern bio-scientists do not try to know and understand even dialectical materialism, so that it may be difficult that this author advises them to convert formal logic directly into "bio-dialectic."

But it is essential to modern scientists that they should know and understand not only dialectical materialism but also "bio-dialectic" explaining that originally matter and mind should be indivisibly unified in a body.

For, today materialistic thought that matter is prior to life and spirit is very common both to those who are dependent on formal logic and to those who believe in dialectical materialism. And, as a result, mankind is now thrown into uneasiness, or *Angust*, and confusion. Furthermore, mankind is now threatened by environmental pollution, such as air-pollution, water-pollution, soil-pollution, which is caused by the trend of the priority of industry and economy. And of course, nature is, being destroyed.

Therefore, this author insists that we should lose no time in creating true scientific methodology, or true philosophy, in order to tide over such a crisis of mankind.

⑧ True religion and true science should be united.

Religion and science were both created by man, but somehow they have been confronted with, or opposed to, each other since the times of ancient Greece. Many people think that both of them look like the parallel lines which can never intersect with each other forever because they are different in ground. This may express the fact that religion is under a bias towards spiritualism, while science is under a bias towards materialism.

In other words, this may be because of the polarization of human spirit.

There lies a big gap in methodology between an idealist and a materialist, for the former thinks that human spirit which is most highly developed is the centre of all things, while the latter thinks that matter which is lifeless is the origin of all things. Therefore, it may be said that they both are poles apart in thinking, or in methodology.

The reason they both are poles apart in thinking is that they both miss or neglect considering wholly and evolutionally the relation between living things and lifeless things, and between matter and energy.

Therefore, this author suggests that spiritualism and materialism should not be opposed to each other in vain, but they both should be preferably unified in a body, considering the relation between matter and energy evolutionally or genetically.

⑨ Energy and matter

It is a fact that today dialectical materialism and formal logic are both under a bias towards materialism. This arises from the fact that those who are dependent on dialectical materialism or formal logic look only on the one side of the shield, but they do not try to look on the other side of it, or they do not try to consider the relations between matter and energy evolutionally.

It goes without saying that true philosophy should be founded on monism.

Today physics and other sciences such as biology and medical science which are dependent entirely on physics and chemistry may be founded on monism explaining that energy is attributed to matter, and energy is the force held in matter originally.

but on the other hand, matter is defined as a thing which holds definite mass and some electric charges, and then as a thing which consists of the elementary particle, the most minute one. And an elementary particle is regarded as an inseparable unit of energy and matter.

My opinion on true energy (ultra elementary particle) will be described in the following item.

(11) "Bio-dialectic" is the very philosophy that the medical science and life science of tomorrow should be founded on.

① Which arose first, matter or energy, evolutionally?

We should consider the relation between matter and energy on monism, not on dualism. And then we should look at it evolutionally.

In modern physics or in the theory of elementary particles, ultimate minute particles of which matter is composed are considered elementary particles, while an elementary particle is defined as the minimum unit that holds both mass in matter and electric charges in energy. But this is open to question. In modern physics, energy is generally defined as an attribute to matter entirely on materialism, but that is an unreasonable definition because there are the two terms-matter and energy-which are equally opposed to each other. For, on the one hand, it is possible that matter is composed of the particles of energy, but on the other hand, it is also possible that energy is composed of the minute particles of matter.

In short, this problem is dependent on how we should define the two terms-matter and energy. For, we can define a human body as a mass of energy, while we can define it as a mass of matter.

This author will give a detailed account of it later.

② It is unreasonable that the priority between matter and energy is discussed on spiritualism in which human spirit is considered the centre of all things.

Natural scientists are liable to think more of matter because the object of their studies is nature, or matter, while many religionists and idealists are liable to think more of spirit because they are dependent on spiritualism. But it is unreasonable that the priority between matter and energy

is discussed entirely on spiritualism or on materialism only.

Therefore, it is necessary that we should throw light on the relation between matter and energy on true philosophy.

③ A photon belongs to a transitional phase from ultra-energy into an elementary particle.

In modern physics, light is defined as a particle and then wave. This may be a contradiction. For, it is generally said that light is originally composed of elementary particles called "a photon", but if light is also wave, something or a medium that transmits wave must exist in the space.

And then the medium is considered something that cannot be physically measured. Thus, some of the physicists suggest that we should admit the existence of "ether" again. What on earth is the entity of ether with which space seems to be filled?

It is the general way of thinking of scientists that whatever cannot be measured through the sense organs of man is nothing. But this way of thinking is not correct. For it is based on formal logic, or on logic of "yes-or-no" or "all-or-none", explaining that things must be clearly divided into A or B.

A intermediate portion between "yes-or-no", or "all-or-none", ought to be considered because nature is continuous.

Therefore, this author suggests that we should see that light holds both sides of matter and "ultra-energy", and then light belongs to a transitional phase from true energy or ultra-energy with neither mass nor electric charges. To an elementary particle, for a photon holds some electric charges, but has no mass.

Thus, a physical point of view that light is something involving a contradiction in itself because there exist the two technical terms-matter and energy-particle and wave which are equally opposed to each other.

④ A neutrino is not matter any longer, but "ultra-energy"

In modern physics, it is considered that matter—even an elementary particle regarded as the minimum unit of matter—holds definite mass and some electric charges, while a neutrino is nought both in mass and in electric charges.

Therefore, a neutrino does not come under "the definition of matter" in

modern physics. Namely, a neutrino is not matter any longer.

From a continuous point of view on nature, just as light is considered something that stands midway between matter and energy with some electric charges, so a neutrino is considered something that is more primitive than an elementary particle. In other words, it may be called "a primordial or ultra-elementary particle" or "a pre-elementary particle".

This opinion may also correspond to the theory of "ether" or the theory of the elementary domain Dr. Yukawa established.

⑤ Elementary particles may be created through the centripetal, spiral movement of "ultra-elementary particles".

It is thought that "ultra-elementary particles" may be condensed, and then elementary particles may be created, through the centripetal, spiral movement of "ultra-elementary particles", but this corresponds entirely to a dynamic and continuous point of view or an evolutionary point of view. This may be also said to be a continuous point of view that tries to sublimate, or *aufheben*, and unify both science and religion, materialism and spiritualism, which are opposed to each other.

But religionists, idealists, and materialists are liable to confound "an ultra-elementary particle", or true energy, which is still lifeless, and the mental energy of man which is the most highly evolved one. They both should not be discussed on the same level of evolution with each other.

For, the mental energy of man has been created through the long history of the evolution of inorganic energy. And there is a great difference between both of them in that if he will only push the button of nuclear arms, man can display such a great power as destroys even the whole world, even if his mental energy is physically very small.

⑥ The reversibility between matter and "ultra-energy"

Modern physics is founded mainly on the principles of irreversibility and discontinuity, and the First Law of thermodynamics—the law of the conservation of energy, and the Second Law of thermodynamics—the law of the increase of

entropy—are regarded as a fundamental rule in modern physics. But assuming that there exists a continuity between matter and "ultra-energy" at the primordial stage of energy which may be considered "a sort of ether", as mentioned above, the First law—the law of the conservation of energy—will not hold good. For it is possible that an elementary particle may be converted into "ultra-energy" like a neutrino.

The second law, the law of the increase of entropy, explains that all natural phenomena including life are irreversible because the direction of time-arrow is thought to be one-way in it, but means only "probability" in the closed system which this world is assumed to be. And then it has not always been proved that the whole universe is the closed system.

Furthermore, there is no decisive proof of the existence of probability belonging to a reverse law of the second thermodynamic.

Especially as for life phenomena, as long as organisms live and grow, entropy trends to decrease. Organisms, of course, belong to the open system, but they show the very opposite phenomena to the second law of thermodynamics. Life phenomena are so complicated and reversible that the principles of physics cannot be simply applied to them. For instance, such life phenomena as rejuvenation, de-growth, and reproduction are extremely complicated and then reversible.

In the world of lifeless things, just as an elementary particle reverses its to "ultra-energy" as mentioned above, so uranium with a large atomic value and other radioactive elements give off their electrons naturally for a long time, and reverse into lead or other elements gradually through the centrifugal spiral movement of their own electrons. This may express the fact of reversibility that matter evolves through the centripetal spiral movement while it revolves or degenerates into pre-elementary particles through the centrifugal, spiral movement. The upshot is that an elementary particle revolves into an ultra-elementary particle "ultra-energy" or "ether" and then begins to evolve again. (Fig. 8-1)

This author may be an outsider of physics indeed, but he dares to propose that the two principles in modern physics—the First law and the Second law of thermodynamics—should be re-examined because they are thought to be unsuitable for explaining all natural phenomena including life from his view.

matter, as stated above. For instance, Dr. Tomonaga, a Nobelist for physics, says, "Physics is now in an impasse", and then Prof. Bernard, Professor of London University, says, "We are now seeing the period of reformation in physics. So we do not modify the conventional principles of physics partially, but we should try to reform them fundamentally and wholly".

These brief comments on modern physics may correspond entirely to this author's opinion that we should get rid of formal logic, and make an overall reformation of the conventional methodology of science, with a view to understanding the reversibility and continuity of natural phenomena.

It is a well-known fact that when it travels through Wilson's fog-box, light is divided into protons and electrons with minus charges. Indeed, this may be very interesting in respect of the reversibility of an elementary particle, but it is open to the charge of one-sided view of light explaining that light is only a particle.

Therefore, it is necessary that we should see the truth of "the uncertainty principle" discovered by Heisenberg in 1925, and understand "bio-dialectic" centering waviness and spirality advanced, by this author in order to consider the contradiction that light is a particle, and then light is wave.

And it is assumed that the centripetal spirality shows the direction of evolution from "ultra-energy" to matter, while the centrifugal spirality shows the direction of diffusion from matter to an elementary particle. In other words, the centripetal spirality shows the direction of the evolution of atoms or organisms, while the centrifugal spirality shows the direction of the degeneration of atoms or organisms that are a mass of atoms.

⑦ An illustration on the reversibility between matter and "Ultra-energy"

An illustration on the reversibility between matter and "ultra-energy" will be given as follows (Fig. 8-2):

① an ultra-elementary particle—"ultra-energy" or "ether"— through the centripetal, spiral movement or vortex → ② an elementary particle (in which matter and energy are indivisibly unified in a body) → ③ an atom → ④ a molecule → ⑤ protein → ⑥ a unicellular organism → ⑦ a multicellular organism → ⑧ man (in whom matter and mind are indivisibly unified in a

body)

Notes: The arrow "→" shows the A. F. D. Process—the direction of development or evolution, while the arrow "←" shows the reverse A. F. D. Process—the direction of diffusion or degeneration.

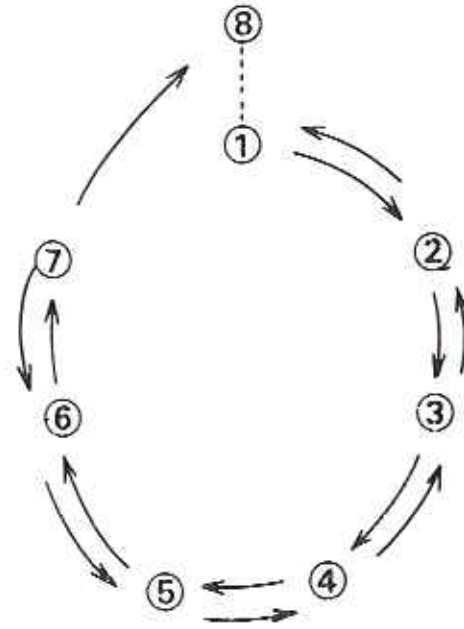


Fig. 8-2

elements, emanating elementary particles and ultra-energy. (K.Chishima)

Fig 8-2. An schematic illustration on the reversibility between matter and "ultra-energy"

- Notes: ① ultra-energy or true-energy
 ② the intermediate phase between ultra-energy and an elementary particle, e.g. a photon.
 ③ an elementary particle, which has been referred to be the smallest unit of matter and energy.
 ④ an atom, e.g. an hydrogen atom.
 ⑤-⑧ the evolution of an atom, and ⑧ are the radio active (heavy)

CHAP. II. "Bio-dialectic" and its View of the World

(1) The 4-D world in physics the space-time continuum.

A dimension is generally defined as an expanse of space or time, or as a limit to the movability of direction. A line in space shows the 1-D world, a plane the 2-D world, and a solid the 3-D world, respectively. Einstein added "time" to these three dimensions in his theory of relativity, and assumed that there exists the 4-D world, or the space-time continuum. According to his theory, when an object moves, length and time are shortened, and the mass of the moving object increases. If a rocket travels at the velocity of light at the rate of 300,000 km. per second, the rocket will be shortened to zero in length theoretically, and at last disappear. Or if we travel in the universe at the velocity of light for only a few years, and return to the earth, we shall be called "a Urashima" of today—"a Rip van Winkle" of today. For, only a few years in the universe is considered scores of years on the earth.

Thus, it is well known that a great revolution was brought to classical physics by the advent of "the theory of relativity" explaining that space and time do not belong to each system quite different from each other, but both of them belong to the same system, or to the 4-D space-time continuum.

① The world on the theory of relativity of Einstein

In the 4-D world-image, or *Weltbild*, on the theory of relativity of Einstein, it is explained that this world is, in reality, only a projection of the fixed model, or only a projection of another world—the 4-D space-time continuum which is composed of 3-D space and 1-D time. Dr. K.Hashimoto compares it to a moving picture. And he explains as follows:

"Assuming that the film of a moving picture is that of the 4-D space-time continuum, some image on the screen is seen as a twisted one different from the real image when the angle of a projector is changed, some as a larger

one when the projector is set farther off, and some as a smaller one when the projector is set nearer. And then time on the screen passes faster when the projector is revolved faster, while it passes more slowly when the projector is revolved more slowly. Therefore, it may be said that the image of a moving picture is not absolute but relative both in space and in time".

Hereupon, it is necessary that we should try drawing the 4-D graph which combines 1-D time with 3-D space in order to show the movement of the sun, the earth, and the comets which can move freely anywhere in the 3-D space, covering the past, the present time, and the future.

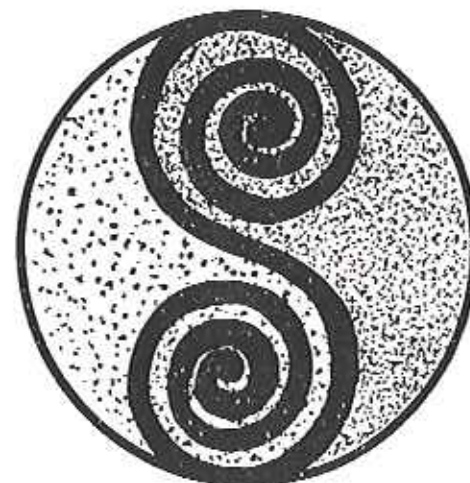


Fig. 8-3. A Symbolic pattern of Bio-dialectic presented by this author (K.Chishima)

Dr. Hashimoto explains that the model of the 4-D world shown in the above graph is an unchanged, absolute one, and then this world, or the world of phenomenon, which we can feel through the five senses is only a cross section of the model which can be seen when a certain part of the model is cut at a certain angle. When the angle of cutting is changed, a world appears where space diminishes in size, and time passes slowly. The axis of time in the above graph is a combination of time with the velocity of light, or a combination of one second with 300,000km. per second.

According to his theory, all phenomena are relative, and if the world shown in the above graph really existed, force and energy in the world of phenomenon would be completely denied, and then gravitation would not be permitted.

He also says that it is proved that the 4-D space is bent or twisted, for even light which is nought in mass passes by the sun twistedly at the angle of 1.6 second when it travels straight through space. It is natural that he should explain that it is because of the twist of the 4-D space that though a photon which is nought in mass ought not to be pulled by the gravitation of the sun, yet it passes by the sun twistedly at the angle of 1.6 second.

Indeed, the structure of the 4-D space-time continuum in the above graph and this author's wavy, spiral view of life may be both much in common with each other, but both are quite different from each other in the most essential point.

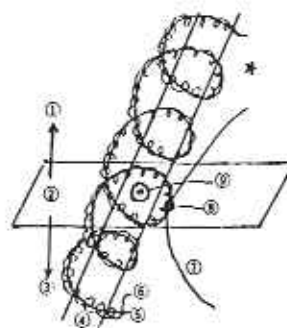
This is the very point that this author thinks Einstein and other scientists have not taken notice of. (As for the particulars, see another volume (vol. 7) on the wave-spiral tendency of life).

This author will present here an parapsychological view of the world which has something in common with this author's before he explains his biological view of the world which may be called "Weltanschauung" rather than "Weltbild".

② A parapsychological view of the 4-D space-time continuum

Some of the researchers on parapsychology, such as Dr. K. Takahashi and Mr. Yamada, assume another 4-D world which is quite different from the 4-D space-time continuum on the theory of relativity. Dr. Takahashi explains it in his volume "AN INTRODUCTION TO THE STUDY OF PARAPSYCHOLOGY - Solving the Mystery of the 4-D World" as follows:

"The 4-D world is a locus which a cube with length, the width, and height draws when it moves at right angles, but because his sense is three-dimensional, man will not be able to measure it scientifically or man will not be able to imagine it, even if he tries to measure it on his sense. For instance, as for the image of the 3-D cube which is projected on the 2-D plane, when one airplane flies over the surface of the earth, and the other over the back, these two airplanes look as if they were going to collide with each other, if the two images of them on the 3-D world are projected on the 2-D plane as follows--"



Notes: ①...the future

②...the present time

③...the past

④...the world-image of the sun

⑤...the world-image of the earth

⑥...the world-image of the moon

⑦...the world-image of a comet

⑧...the earth

⑨...the sun

Fig. 8-4. 4-D continuum of earth, sun and a comet (K. Takahashi)

"Assuming that there exists another 4-D world quite different from the 4-D space-time continuum on the theory of relativity", says he, "We see only the shadow of the real world through our sense-eyesight-that is three-dimensional".

And then, as an inexplicable phenomenon in the 3-D world, he illustrates the phenomena such as teleporation, a flying saucer, ectoplasm, clairvoyance, "nensha" - a sort of psychokinesis arising from writting letters, bearing things in mind - which was discovered by Dr. Fukurai, precognition, mind reading, and the like, which can be seen in the field of parapsychology. As for "nensha" - a soft of psychokinesis, he explains that it is possible that the world of matter in future may be changed through "nensha", or writing letters, bearing things in mind, for matter is an image which the mind draws, and then a reflection which is projected from the higher dimensional world.

Dr. Takahashi goes on to say, "The 4-D world in which matter and mind are indivisibly unified in a body is the world of mind. From the results of my experiments on clairvoyance, precognition, and mind reading, it is proved that

those who hold these E. S. P. powers can predict the future, rising above space. These E. S. P. powers can never be explained through the physical media such as an electric wave, a power wave, and a neutrino. The 4-D world I advance is the world of mind, and matter is floating on the sea of mind. The whole world lies on the sea of mind, and matter is a vortex or a spiral on the sea of mind. It is not until we know that matter is an image of the mind that we can explain well these parapsychological phenomena".

Moreover, he daringly says, "I can shake the hand of an ammeter through "nenriki", or psychokinesis, using the experimental device I designed".

③ This author's thoughts on Dr. Takahashi's theory.

Dr. Takahashi's theory is very important in that it tries to correct a tendency toward the world-image, or *Weltbild*, in which matter is considered the centre of all things. This author takes a great interest in respect that he emphasizes the importance of mind, making much of parapsychological phenomena. But, as for the common researchers on parapsychology, it is necessary that they should collect more accurate facts, and examine them more precisely, for a good many of the phenomena which are generally called a parapsychological one are actually fabrications. On the other hand, the orthodox scientists should mend the attitude that what is inexplicable within the limits of modern physics is all false. For instance, if a phenomenon that can be very rarely, or only once, seen in the natural world is true, we should venture to reform the orthodox theory so that it can be applied to the phenomenon, instead of excluding or neglecting it. For, in science the fact is first, the explanation the second.

The main reason this author sympathizes with, and takes interest in, Dr. Takahashi's theory is that he is boldly taking a defiant attitude toward the world-image of modern physics on materialism. Namely, there cannot exist the world which is completely objective, for so long as an object is observed by man, it is always more or less influenced by his mental energy.

The world which Dr. Takahashi calls "the sea of mind" may correspond to the world of "ultra-energy" or the world of "ether" which this author advances. The theory of Dr. Takahashi that matter is a vortex or a spiral floating on the sea of mind has something in common with that of this author that "ultraenergy"—an ultra-elementary particle—is converted into an elementary

particle, in which matter and energy are indivisibly unified in a body, through the centripetal, spiral-movement of "ultra-energy". But it is open to question that he uses the technical term "mind" or "spirit". For those who think more of spirit, including idealists, are liable to regard the mental energy of man, which is considered most highly-evolved, in the same light or on the same evolutionary level with "ultra-energy" or "ether" on the lower level which is assumed as a universal existence in the cosmos. Therefore, it is necessary that we should see that there exists an evolutionary progress from universality to peculiarities, or from a homogeneous existence to a heterogeneous one. And then we should take a spiral or dialectical point of view that the extremity of evolution means degeneration, that is, a thing generates, develops, and at last degenerates, or recurs to the primitive state.

If we don't take this view, it will be impossible that we try to sublimate, or *aufheben*, and unify religion and science, or psychic phenomena and science.

CHAP. III. The 4-D Spiral World of K. Chishima

(1) Comparison between The Physical 4-D Space-time Continuum and this Author's 4-D spiral Space-Time Continuum

Both³ the 4-D world-image, or *Weltbild*, of Einstein and the 4-D parapsychological world-view, or *Weltanschauung*, of Takahashi are common with each other in taking a straight-lined and geometrical point of view. Especially, this is distinct in the axis of time as shown in Takahashi's model.

It is true that the movement of the earth or the moon is shown as a spiral in the model of the 4-D space-time continuum because the earth or the moon moves round the sun spirally, but it is open to question that a straight-lined timeaxis is drawn centering the sun. For that time covering the past, the present time, and the future is drawn in a straight line means just that all

phenomena in the universe are irreversible. In other words, the model follows the second law of thermodynamics—the law of the increasing in value of entropy—that the arrow of time goes straight on, and never returns. But the law of the increase of entropy expresses only probability within the closed system.

The assumption is not absolute that the whole universe is the closed system, and then it cannot be concluded that the probability of the decrease of entropy is absolutely nought in the closed system, even if the whole universe is the closed system. Though organisms belong to the open system, entropy in them surely trends to decrease through the process of generation or evolution, that is, they evolve from homogeneity or equality to heterogeneity or distinction, or from simplicity to complexity. Assuming that the big universe which is beyond the powers of physical measurement is the open system, the law of the increase of entropy of course, will not hold true.

It is simply because of its approximate value that the law of the increase of entropy is approved of in modern physics. There still remain many phenomena in this world which can never be explained in the 4-D straight-lined and geometrical world on the irreversibility of phenomena in which the axis of time is considered a straight line. These phenomena unknowable in the 4-D straight-lined and geometrical world would be well understood if we know the tendency of organisms toward repetition, periodicity or waveness, and spirality in such life phenomena as the origin of life, reproduction, development, heredity, and evolution.

According to this author's studies, bacteria are repeating spontaneous generation on the earth every day. Ontogeny repeats phylogeny: an individual repeats its evolutionary history, shortening it little by little. Genetic phenomena repeat it as well. Thus, we should know that the evolutionary history of organisms has continuously repeated itself on the earth. For we would never be able to explain the birth and development of the globe, the origin and evolution of life, and especially the phenomenon of orthogenesis, if we did not assume that the globe has pursued its evolutionary history over and over again, not once.

"samsara"—transmigrationism—from old times in the Orient, and "*ewige Wiederkunft*" of Nietzsche arised from the results ancient people and philosop-

hers produced through their keen insight through which they saw into the periodicity or waveness and spirality of changes in the world.

These theories say only the eternal, circular repetition of the same phase of things, while this author's theory says that things do not repeat the same phase, but they repeat a somewhat varying phase rather than the last one by degrees; they change spirally. These theories and my theory are essentially different in this respect.

Notes: Orthogenesis is the theory that organisms evolve blindly toward the definite direction by some mysterious factor which can never be explained in the natural selection theory of Darwinism, and it is also called ortho-evolution. This theory was published by Eimer in 1885, but some of the biologists refute it today.

But this may be well understood only by this author's theory, or the theory of the spiral space-time continuum, that the globe and organisms are spirally repeating their evolutionary history — the history of their birth and development—which has been spirally repeated over and over again covering the past and the present time, that is to say, the spirality or reversibility of time arrow.

(2) The 4-D world-image of Einstein is materialistic.

Natural science, especially physics, in the Occident is materialistic. Einstein's way of thinking on matter, energy, force, and movement is based on materialism.

This may be unaboidable when it is considered from the nature of physics in which matter is the object of its study, but so long as modern physics abide by monism explaining that energy is attributed to matter, or energy is a capacity of matter, they will not be able to explain completely not only the life phenomena but also the mental phenomena of man who is most highly developed, as stated above.

There still remain so many phenomena in this world which can never be explained by physical monism explaining that all things are made of matter.

So far as this is concerned, we should listen to the theory of the parapsychological space-time continuum, as mentioned above, which Dr. Tanahashi presented. But it is impossible that according to his theory, we try to sublima-

te, or *aufheben*, and unify materialism and spiritualism, science and religion, mechanism and vitalism, which are opposed to each other, because his theory has a great tendency toward spiritualism.

In short, it is impossible until we begin to think of the evolutionary level, the reversibility or the spirality of 4-D continuum, and the relationships between the mental energy, or "ultra-energy", of man (which is most highly developed) and the ultra-elementary particle, or "ultra-energy", (which is lifeless and low-ranking) that we must sublimate, (or *aufheben*) and unify materialism and spiritualism, science and religion, mechanism and vitalism. (As for the particulars, see Fig. 8-3)

(3) The spirality and asymmetry of the cosmos.

Einstein explains in his theory of relativity that it is because of the twist of space that light draws a curved line when it pass by the sun. But on the other hand, there are many facts that moving things hold asymmetry in themselves. For instance, this author can show such examples as asymmetrical carbon, atoms, colloid molecules, *spirochaeta pallida*, and other microorganisms.

The spin of asymmetrical carbon and atoms, the structure and movement of *spirochaeta pallida*, colloida molecules, and other microorganisms, and other numerous spiral movements which can be seen in a living body, arising from organized asymmetry — this is all the pattern of inevitable movement which the asymmetrical things show when they try to exclude resistance arising from asymmetry, and to move freely.

Therefore, it is necessary that we should consider the asymmetry of the microscopic world as well as that of the macroscopic world. (As for the particulars, see the book of "Chishima's THE WAVE & SPIRAL TENDENCY OF LIFE PHENOMENA ... complete works serial book" — vol. 7)

(4) The two fundamental principles of modern physics are open to question.

One of the two fundamental principles of modern physics is, of course, the First Law of thermodynamics which is also called "the law of the conservation of energy", but the definition of energy in it is extremely ambiguous.

For energy is defined as one attribute of matter in it, not as the very thing that is equally opposed to matter, because it is based on materialism. But of the elementary particles which are regarded as the minimum unit of matter, and in which matter and energy are indivisibly unified in it, therefore a neutrino cannot be called matter any longer because it is nought both in mass and in electric charges. So it may be said that a neutrino is neither mere matter nor energy. In order to understand a neutrino correctly, we have no choice to assume the field of an ultra-elementary particle or "ultra-energy" which may be also called a pre-elementary particle. And then we should know that there is possibility that an elementary particle evolves into an atom through the centripetal, spiral movement of an ultra-elementary particle or "ultra-energy" which is equal to nought both in mass and in electric charges.

What we call energy is not constant but variable energy is always converted into "ultra-energy". Therefore, energy decreases, while "ultra-energy" increases. Similarly, matter is not immortal but mortal; matter is always converted into "ultra-energy".

Thus, the First Law of thermodynamics—the law of the conservation of energy—is open to question because it is founded on "constancy".

There exists nothing constant in the universe, but "All things change" is the only constant truth.

Besides, as for the Second Law of thermodynamics—the law of the increase of entropy, there are many phenomena in the natural world that do not correspond to it both in theory and in the facts, as mentioned above. For this world including life phenomena moves and changes continuously according to the principle of repeat and spiral movement. Therefore, it is certain that the time will come when modern physics will be fundamentally reformed on the principle of wave and spirality in order that this world including life phenomena will be better understood.

In 1925, Heisenberg presented the uncertainty principle that it is impossible to measure the position and movement of electrons accurately, which is very significant in that it puts in question the limits of the senses of an observer and the interference of light in the microscopic world or in the world of electrons. And then the theory of relativity of Einstein shows that even the principles of physics are not completely independent of man (the observer).

Thus, it is necessary that we should mend the tendency of modern sciences towards materialism, especially the two laws of thermodynamics in physics, and establish a new theory on the principle of wave and spiral movement in the natural world including life phenomena, only by which we shall be able to understand the universe and life better.

(5) Even the inanimate materialistic world moves and changes on the principle of waveness and spirality.

A periodic table of elements discovered by Mendeleev could be shown as a periodic pattern on the evolution of elements in the 2-D world, or as a 2-D spiral in the table of Newland. But according to my opinion, space-time continuum must be referred to 4-D spiral.

In other words, this expresses that the axis of time is a spiral line. And then it is known that when the time-axis is shown as a spiral or a reversible line, radioactive elements with many outer electrons give off electrons gradually from their outer part, and return to lead after two thousand years.

This expresses that originally atoms hold both sides of evolution and degeneration, that is to say, the A.F.D.Process and the reverse A.F.D.Process.

Besides, the sun, the earth, the moon, and the like in the macroscopic world as well as in the microscopic world move and change on the principle of waveness and spirality.

(6) Chishima's model of the 4-D spiral, space-time continuum

The following is the model of the 4-D spiral, space-time continuum which this author has discussed in the first to the fifth paragraph in the Tab.8-1.

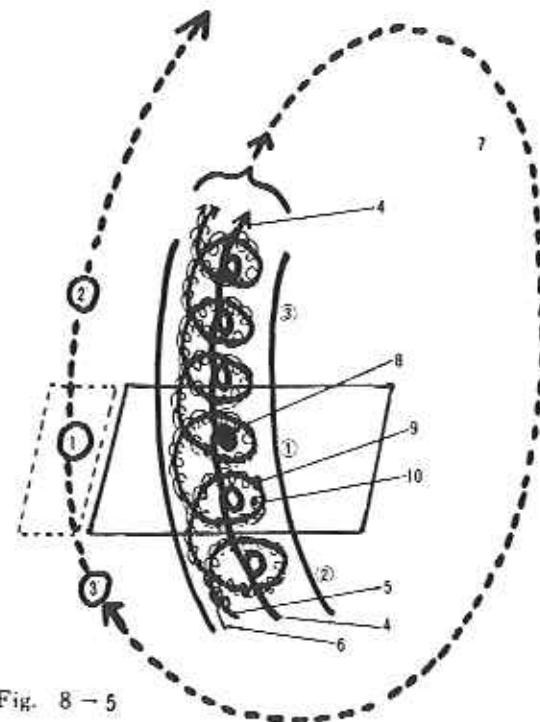


Fig. 8-5

Fig.8-5. A Schematic illustration of the 4-D space-time spiral continuum presented by this author (K.Chishima)

- Notes: ①...the present time.
 ②...the past.
 ③...the future.
 ④...the reversed present.
 ⑤...the reversed past.
 ⑥...the reversed future.
 ⑦...the world-image of the sun.
 ⑧...the world-image of the earth.
 ⑨...the world-image of the moon.
 ⑩...4-D space-time spiral continuum which involves all the history of the cosmos including the sun, comets, planets, spiral nebulae and living beings.
 ⑪...the sun.
 ⑫...the earth.

CHAP. IV. Which is more preferable, the Orthodox Doctrine or Chishima's Heterodox ? — And its Criterion ?

From the first to the eighth principle of Chishima are quite opposed to the orthodox theory on life and medical science, but this author is sorry to say that they has not yet been completed. This author still leaves unfinished many experiments he ought to have made. This is that unfortunately this author has not been blessed with his assistants and his studying environment because he is a heretic and a poor investigator. This author, however, believes firmly that his new theory is quite right in its framework, for it is founded both on true scientific methodology and on the facts.

This author will present some grounds for reference in the following as to which is preferable, the orthodox doctrine or this author's heterodox.

(1) Whether a theory is right or wrong should be examined both on the facts and from a logical point of view.

As mentioned previously, it goes without saying that whether a theory is right or wrong should be examined both on the facts and from a logical point of view. However, it is extremely difficult in many respects that people try to re-examine my theory in detail, but it may be altogether easy that they try to apply it to everyday life or to health promotion, comparing it with the orthodox theory. Moreover, I expect that if they take this thinking method, they will quite easily understand which is more preferable, the orthodox doctrine or my heterodox. And then, if they compare such ways of looking at things or ways of thinking as formal logic, idealistic, idealistic or materialistic dialectic with my "bio-dialectic" pursuing the difference between them they will be able to judge correctly which is more preferable, the orthodox theory or my heterodox for the facts always corresponds to a true theory.

(2) Difficulty in pursuing pure objectivity in the field of science

Natural science always makes it its principle to pursue pure objectivity, while man who ought to be quite objective in his studies holds both reason and sentiment originally. So it is, in reality, extremely difficult that man tries to study nature quite objectively. This corresponds exquisitely to the uncertainty principle of Heisenberg pointing out the limits of the senses of an observer. And then the same is true of the macroscopic world as well as of the microscopic world. It is natural that a scientist should try to be quite objective, to exclude his individual prejudice as much as possible, and to describe nature as it is or life phenomena as they are as modestly as possible, listening to reason, but there are not a few cases where his reason is clouded or swayed by sentiment because he is man not only with reason but also with sentiment (emotion), or because he is an animal with sentiment. Sentiment is more primitive than reason. At the present stage of the evolution of mankind, the action of man is latently influenced by sentiment or emotion, whether he is conscious of it or not. This is the reason man is called "an animal with sentiment".

Now, to this author's regret, there are many scientists who do not dare to say, or accept, "What is true is true", knowing it at heart because they stick to their benefit, reputation, and pride too much. This may express exactly the weakness of man plainly.

It is surprising how much such human sentiment should have checked the true development of science. The history of science will plainly tell us how much the scholars such as Galilei, Copernicus, and Mayer who discovered a revolutionary, new theory were persecuted by the orthodox scholars and the world, and then what a hard way they had to take in their life.

It is not too much to say that the history of science is that of how much persecution and pressure the orthodox scholars and the world have inflicted on the heterodox scholars who have discovered a revolutionary, new theory. But, today there are only a few scholars who can strive for the harmony of reason and sentiment. A true scientist would find courage to accept frankly,

"What is true is true". Nature always reveals her secret only to those who hold wisdom, correct judgement, insight, and honesty. On the other hand, it may be said that those who do not dare to say frankly, "White is white, black is black", are not qualified for a true scientist.

(3) Scientific truth changes along with the times and the social structure.

Many of the things which are called scientific truth change along with the thought of the ages and the social structure. As mentioned previously, "All things change continuously" is the only eternal truth, if there is invariable truth in this world. This expresses the wavy, spiral movement of life, and then it corresponds exactly to "bio-dialectic" philosophically. If we examine which of the two—the orthodox theory and this author's heterodox—corresponds better to this philosophy of change, comparing the former with the latter in detail, it will be quite easily understood whether "bio-dialectic" is right or wrong.

This author's new theory is the one that makes synthesize "dialectically the antithesis dialectical materialism and the thesis idealistic dialectic, into "bio-dialectic" explaining that matter and mind are indivisibly unified in a organism complying with the request of the times.

(4) A challenge to the trend of contemporary thought toward materialism

Today there lie the two worlds—the free world and the Communist world—which are opposed to and contend with, each other. One world centering America is founded on formal logic and pragmatism, while the other centering Soviet is founded on dialectical materialism, but it is a wonder that both camps should be altogether consistent with each other both in the materialistic way of looking at things and thinking and in that matter or economy takes precedence of all others. This is just the age of material civilization. Matter or material culture is prior to mind or spiritual culture. Nature is being rapidly destroyed, environmental pollution occurs in succession, and as a result, the earth is getting harder and harder to live in. Besides, mankind is always ex-

posed to a nuclear threat. As for medical science, it seems that even doctors are becoming economic animals.

From these facts, it may be said that with the development of Occidental civilization—material culture—in which matter and machines are thought much of, while Oriental civilization—spiritual culture—in which nature, simplicity, and harmony are loved and respected, has been oppressed by the former, and, as a result, the latter is obliged to go backward. But this author insists that this is the transitional period when Oriental civilization centering spiritual culture and Occidental civilization centering material culture should be both well harmonized and well developed. Moreover, this author believes firmly that his revelational, new theory—"The Eight Principles on Life and Medical Science"—is the only one that sublimates, or *aufheben*, the trend of contemporary thought toward materialism, and complies with the request of the times. And also this author believes that it will be useful enough in the coming age, or in the twenty-first century, when life and man will take precedence of all others.

(5) From analytical science to synthetic science : part and the whole

It has been said that both analysis and synthesis, both deduction and induction are necessary for natural science, but modern natural science is, in reality, under too strong a bias toward analysis. Therefore, the orthodox scientists are liable to stick to "part" too much, neglecting "the whole".

Especially, medical science and biology are greatly influenced by this tendency today. For instance, many of the medical scientists are in exclusive support of medicine and *mes*, or a scalpel, so they are liable to treat only the trouble of a patient physically, neglecting his person and his mind, as a whole. And then they are dependent entirely upon symptomatic treatment, neglecting fundamental treatment or natural healing. Thus, the people become more and more distrustful of the present medical treatment, and the medical scientists who are apt to think light of medical ethics, and try to treat only the trouble of a patient physically, neglecting his person and his mind. And then the practicing doctor system under which economics—profits—seems to be prior to all

others is, at present, a subject of discussion.

This tendency is, of course, much more remarkable in the free world than in the Communist world.

But life and human nature hold many things that cannot be explained simply by the physical and chemical laws or by analysis. The whole is not the arithmetic total sum of mere parts but something other than it. This expresses the importance of the wholeness of life.

Today, biology and medical science are dependent completely upon physics or chemistry whose object of study is only an inanimate object but a living body holds its own peculiarities or its own organized wholeness which no lifeless thing holds.

Therefore, it is theoretically impossible that we try to explain the phenomena of life at the higher stage than any other thing, according to the physical and chemical laws centering analysis.

Because the field of medical science is, at present, subdivided into scores of departments, not only patients but also doctors are often at a loss what department they should take for proper treatment. Therefore, it is necessary that we should try to avoid committing such a folly like a lot of blind men feeling a great elephant.

(6) From medicine centering the body, neglecting mind, to medicine striving for the harmony of "ki", "ketsu", and "dō".

Though the duty of medical science should lie, naturally, in promoting the natural healing of patients who hold both mind and body in a living body yet it seems that many of the modern medical scientists mistake their duty for giving aggressive treatment with medicine and *mess*, or a scalpel, as their arms. They should all listen to the following phrase presented two thousand and five hundred years ago by Socrates (469~399 B.C.) in Greece: "Just as you ought not to attempt to cure eyes without head or head without body, so you should not treat body without soul".

Hippocrates (460--377) B.C.) in Greece, who is called "Father of Medicine", and Paracelsus (1493~1541), a prominent Swiss doctor, held the same opini-

on with Socrates.

In ancient Oriental medicine, the harmony of "ki"—mind or spirit, and "ketsu"—blood and body—was regarded as the fundamental principle of health or how to keep fit, but today there are some scholars in the field of Occidental medicine who lay emphasis on the importance of mind or spirit. For instance, Freud in Austria presents "psychoanalysis", Pavlov in Soviet "the theory of a conditioned reflex", from which Nervism in Soviet arose, Selye in Canada "the stress theory", Reilly in France "the excess stimulus pathologic theory on the autonomus nervous system", and then some of the scholars in America and Japan "psycho-somatic medicine".

It may be said that the above new trend expresses the fact that they are recurring to the principle of medical science in ancient Orient and ancient Greece explaining that mind and body are indivisibly unified in a body.

But there are only a few scholars who think much of mind or spirit, while still many of the scholars stick to the body, and are dependent entirely upon aggressive medical science with medicine and *mes*, or a scalpel, as mentioned before, neglecting mind or spirit and "the whole".

Therefore, this author lays emphasis on the harmony of "ki"—mind or spirit, "ketsu"—blood and body, and "dō"—movement or sport, (adding "dō" to "ki" and "ketsu" on the principle of Oriental medicine). For this author thinks that all diseases are caused by the disharmony of these three factors — *ki*, *ketsu*, and *dō*. And then it may be the first consideration that we try to exclude the disharmony of these three factors before everything else in treating all kinds of diseases.

CLOSING REMARKS

This author has described in the Eighth principle how good and how proper "bio-dialectic" explaining that matter and mind are indivisibly unified in a body is as a scientific methodology in order that we may understand life, medicine, and nature. And this author has laid emphasis mainly on the philosophical side of it.

But this author, hereon, insists that we should try to uplift such sentiments or morals as "wa"—harmony—in the Orient, love, and especially humanitarianism in the Occident now, for health, peace, and happiness are desired, in earnest the harmony of true science and true religion are requested today.

CHAP. V. Already published papers on the
asymmetry, wavenes (or periodicity)
and spiral tendencies in the Forms
and Functions in the Organisms

(A) Original papers in English

(Continues to page 443)

I Studies on the Asymmetrical, Wavy and
Spiral Tendencies in the Forms and
Functions in the Organisms **

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(A) Introduction

It is a common experience among biologists and medical investigators to observe the asymmetrical and periodic patterns in living organisms or the periodic (rhythmical) tendency in physiological processes. So that the numerous papers on these problems have been published by many authors throughout the world. However, the majority of those publications have been dealt separately with the forms or with functions confined within relatively narrow and limited fields of investigations. Thus, there are few investigations as to the intimate relationships between the forms (structure) and the functions in the organisms. So far as the writer knows, there is no publication dealing with inclusive the periodic or spiral patterns and their origin in the bird's egg cell, oviduct, egg albumen, blood serum, urinogenital system of chick embryos, etc, and periodic process of movement, behaviour and asphyxiation in aquatic insect, from the dynamic and systematic point of view (Chishima, '29-'60).

Though this paper to be presented is somewhat miscellaneous in character, it is intended to describe the results of my studies including the already published and unpublished data, in brief. In describing these results the author believes it is logical and convenient to divide its contents into the following two chapters:

(1) The asymmetry, wave and spirality in the form (in bird's eggs especially hen's eggs, hen's oviduct, egg albumen, mammalian serum, urino-

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genital organ in chick embryos.); But the results of studies on the asymmetrical development of the urino-genital organ in chick embryos are omitted in this paper because it has already published (Chishima '60).

(II) The wave (periodicity) and spirality in the physiological phenomena, especially spiral movement and the wave of curves obtained from asphyxiation and the other behaviors in an aquatic insect, *Eletes sticticus* Linnaeus.

(B) Results of Observations and Experiments Chapter I

The asymmetrical, wavy (periodical) and spiral patterns in the hen's egg, oviduct and in the dried film of egg albumen or of mammalian serum.

(1) *Correction of the schematic diagrams of hen's egg which have been accepted widely.*

Results of the author's observations on the structure of hen's egg, differ in many points, from almost all of other schematic illustrations which were drawn or cited by about forty other authors (Hertwig, '05; Lillie, '19; Patten, '29; Pearl and Curtis, '12 Romanoff ('49) and others) as a standard illustration of hen's egg. Divergent points between the schemas of other authors and that of the present author (Fig 1) are as follows; (i) position of air chamber, (ii) position and shape of yolk, (iii) position of germinal disk, (iv) altitude of attachment, and the direction of spiral of chalazae, (v) attachment of thick albumen on the inner surface of shell membrane, and the periodic pattern of thick albumen, (vi) indication of outer and inner thin albumen, (vii) periodic pattern of egg shell, (viii) discrimination of three layers, the inner, middle and outer layers of shell membrane. (Fig 2).

(2) *Asymmetrical structure of the hen's egg*

In general, hen's egg is apt to be regarded as a representative cell with symmetrical structure, but it can be seen that egg shows clearly asymmetrical structures in the following points; (i) It is needless to say that the hen's egg has its length and breadth. Though the egg of turtle (*Chelonia Japonica* THUHB) has been regarded as true round shape, as a results of the author's thorough measurement (Chishima '30c) it was revealed that the turtle's egg also has axes of length and breadth. (ii) Long axis of hen's yolk does not parallel with that of egg. (iii) Egg has a polarity, the animal pole and vegetative pole, (iv) Slightly eccentric localization of germinal disk on the yolk, (v) Air chamber of egg localizes slightly upper

position than the center of the blunt end of egg when the egg was laid down horizontally on the floor, (vi) Minute pores of egg shell are not evenly distribute. (Figs. 14~16). The mean value of pore's number in per sq. cm. on the egg shell was 31.1 at the pointed end, 150.3 at equatorial region, and 92.7 at the blunt end. (vii) Difference of altitude of attached

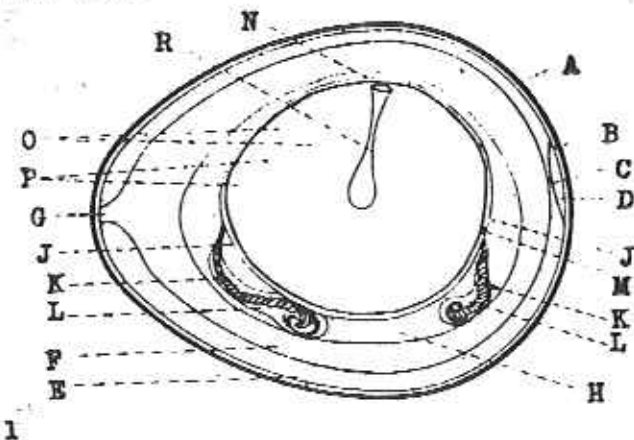


Fig. 1. Diagrammatic representation of the structure of hen's egg, shown by a section through the long axis. From Chishima '32 '33)

Abbreviations :

A, shell; B, outer shell membrane and middle layer of shell membrane; C, inner shell membrane; D, air chamber; E, outer watery albumen; F, thick albumen (consisted from several layers); G, process of thick albumen; H, inner watery albumen; J, membranous portion of chalazae; K, axial portion of chalazae; L, surrounding portion of chalazae; M, vitelline membrane; N, germinal disk; O, white yolk; P, yellow yolk; R, latebra;

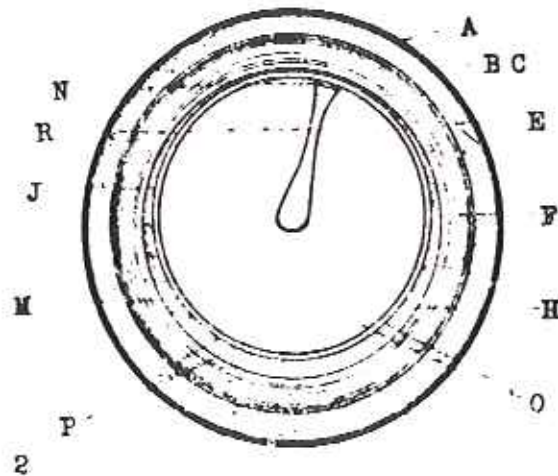


Fig. 2. Structure of hen's egg, shown by a transversal section. Abbreviations are the same as that of the Fig. 1. (From Chishima '32 '33).

points, and directions of spirality of chalazae, and difference in shape and weight between the chalazae attached to the sharp end and that of the blunt end of yolk (Chishima, '31a~c, '32) (Fig. 1)

Chapter I

Consideration on the cause of asymmetry in the egg.

Asymmetries described in (i) and (ii) may be influenced by the facts that the egg passes, spirally, through the narrow lumen of oviduct excluding the resistance of the duct. Asymmetry in (iii) and (iv) is due, most probably, to the effect of gravity acting on the ovarian follicles which are hanging down botryoidally. Cause of asymmetry of (v) is mainly physical factor which is demonstrable by testing the position effect upon the localization of air chamber, in comparing the difference of positions of air chamber under the different conditions between the egg which is set down horizontally and that of the egg set up vertically. (upwards the blunt end).

Mechanism of formation of the characteristic described in (vi) and (vii) has not yet been solved. However, it may be probable that it is determined by mutual relationship between the egg in the uterus and physico-chemical environment within uterine lumen. The characteristic described in (vii) may be originated mainly from the pressure brought by contracted oviduct against the posterior part of egg rotating spirally in the oviduct.

(3) Periodic patterns in the structure of hen's egg and their origin

(i) Periodic pattern of egg shell

It is generally known that the egg shell consists of three microscopic

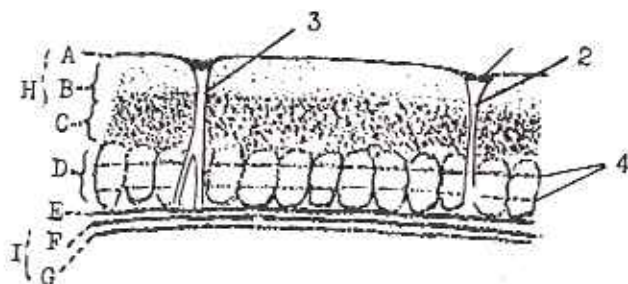


Fig. 3. Schematic illustration of the radial section through the hen's egg shell and shell membrane showing their periodic pattern.

1, cuticle layer and organic material covering on the pore canal; 2, normal pore canal; 3, branched pore canal; 4, two streaks (thin layer) within the mammillary layer. A, cuticle; B, outer spongy layer; C, inner spongy layer; D, mammillary layer; E, outer shell membrane; F, middle shell membrane; G, inner shell membrane; H, cuticle and spongy layer; I, shell membrane. x65 (From Chishima '35a)

layers, the cuticle layer, spongy layer and mammillary layer in its radial section (Almquist, '31; Burmester, '40; Romanoff, '49). By means of thorough examination of scorched egg shell by alcohol lamp or of the egg shell treated with silver nitrate solution it was revealed that the spongy layer is composed, further, of two layers (Figs. 3, 14). Mammillary layer further includes two thin layers within it. (Chishima '35) The periodic patterns of egg shell described above, most probably are derived from the periodicity of calcium-deposition, because they resemble closely the periodic patterns of the other bird's egg shell, shell of mollusca, lamella of Haversian canal and of calcium compounds which were deposited on the inner surface of iron water-pipe.

(ii) Periodic pattern of shell membrane.

Up to now, it is generally accepted opinion that the egg shell membrane is composed of the two layers, the outer and inner layers (Ferdinandoff ('31), Richardson ('35), Burmester ('40) and Romanoff ('49)). But the present author found that there is, further, an outer most layer in addition to the above described two layers. That layer remains in close connection with the inner surface of egg shell after the so-called outer and inner shell membrane were removed. So that the shell membrane consists of three layers, the outer, middle and inner layers. (Figs. 3, 17) (Chishima '35). Formation of the shell membrane is not completed in isthmus of the oviduct, but it is completed at uterus. Keratinous fibers composing the shell membrane are not secreted from the mucous membrane of oviduct in a fibrous condition as it is, but they make their appearance by denaturation of egg albumen in the oviduct. It is not solved why the shell membrane is composed of three layers with different structures, but it is certain that the each of these three layers is formed at different regions of the oviduct, that is to say the inner layer is formed at first, in the isthmus, and the middle layer is formed secondary in the uterus, thirdly the outer layer is formed in the uterus.

(iii) Periodic pattern of egg albumen

If the thick albumen is cut through along the polar axis of it in the water, it will be seen that the thick albumen is composed of seven to eight layers which become visible as several of whitish sheets in pile, by denaturation of egg globulin contained in thick albumen. (Fig. 2). Such a periodic pattern of thick albumen may be originated from the albumen secretion from oviduct around the yolk which is proceeding toward the uterus. (Chishima '32, '33 Yagi and Chishima '32.) Dried film of hen's egg albumen shows periodic wrinkles (Fig. 23).

(iv) Periodic pattern of yolk is generally recognized fact, that is the yolk is composed of several of concentric layers alternating white and yellow yolk layers. (Figs. 1, 2) The origin of such a periodic pattern of yolk can be attributed to the diurnal and rhythmic activity of ovary as has been advanced by Riddle ('11), Nalvandov and James ('49) Romanoff Al L., and A. J. Romanoff '49 and others. Result of the author's histological studies on the growth of ovarian follicles in mammals and aves also agrees with the views of other authors' as has described above. The present author (Chishima '53) found that the yolk spheres are derived from the degenerated (or de-differentiated) erythrocytes.

(4) Spiral structure of the eggs and oviducts in birds

(i) Spirality of chalazae and shell membrane.

Chalazae consists of the following three regions,

(a) the chalaziferous or membranous portion which is attached closely on the yolk surface, (b) the axial or cord portion which is ropy and spiral in form, and hangs down from the both ends of yolk into the inner watery albumen, (c) thick albumen portion, which is adhered around the axial portion of chalazae. Of the two chalazae, the anterior one which is attached at the anterior end of yolk, is longer and heavier than that of posterior end and twisted dextrally, while the posterior one is sinistral. (Fig. 1). Direction of spiral of chalazae is the same in both eggs laid sharp end foremost or in the egg laid blunt end foremost. Mean value of the times of rotation of spiral was about twenty and at a maximum attained fifty in the each of anterior and posterior chalazae.

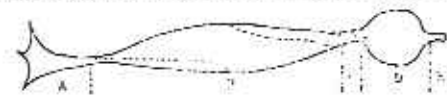


Fig. 4. Schematic drawing of the hen's oviduct.

slitted longitudinally and laid open, in order to show the dextral spiral of the folding (dotted lines) of mucous membrane. A, infundibulum; B, albumen secreting portion; C, isthmus; D, uterus; E, vagina. $\times \frac{1}{9.7}$

mal ones. Formation of chalazae is not completed in the albumen portion of the oviduct but it is in the uterus (Chishima '31a~e, Yagi and Chishima '32).

Though the specific gravity of chalazae is heavier in slight degree than that of egg albumen, chalazae does not play the role to stabilize the normal position of yolk in the egg. It is widely accepted opinion that the chalazae serves to stabilize the position of yolk in an egg. But from the result of the author's experiment in which chalazae is removed experimentally, it was turned out that the chalazae does not play such a function mentioned above. The author (Chishima

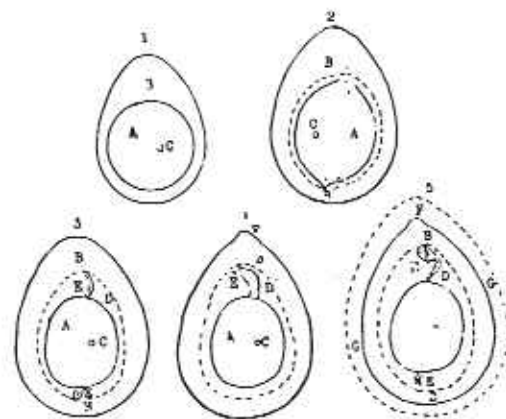


Fig. 5. The formation of chalazae of hen's egg.

Hen's egg. (1) was taken from the upper portion, (2) from middle portion, (3) from lower portion of albumen secreting portion, (4) from the uterus (egg with soft shell), (5) from the uterus (egg with hard shell) of the oviduct. It can be seen that egg (1) show no sign of chalazae formation, egg (2) begins the formation of chalazae, egg (3) chalazae formation has more advanced, egg (4) chalazae formation has advanced further, egg (5) chalazae has almost completely formed. (From Chishima '31d; Yagi and Chishima '32)

'31, Yagi & Chishima '32) has published the following results as to the mechanism of chalazae formation, that is, the yolk ovulated into oviduct does not rotate during passing down, while the thick albumen secreted on the yolk, rotate spirally around the yolk, then denaturation (coagulation) of albumen especially egg globulin takes place by means of mechanical friction

and by the difference of pH between yolk and albumen. Thus there appears thin membrane, the membranous portion of chalazae, on the surface of the yolk, and the distal ends of them are fixed and connected with inner part of thick albumen. Therefore, the distal ends of it (axial portion of chalazae) twist spirally in opposite direction according to the rotation of thick albumen. According to the gelation of globulin, the thick albumen changes from its gelatinous colloidal state into waterly state, the inner waterly albumen. The author's view described above is derived from chemical analysis of egg albumen and observations of fortyeight oviducts from laying hens. Shell membrane also shows spiral wrinkles (Fig. 19).

After all, the spirality of chalazae and shell membrane may be correlated intimately with the spiral form and function of oviduct and with the gelation or coagulation of egg albumen, especially of egg globulin (Fig. 5). Besides the spiral movement of the egg within the oviduct and the uterus, the spirality of the chalazae is due, most probably, to the general tendency of spiral arrangement of atoms in process of gelation of colloidal substance (e. g. egg globulin and egg albumin).

(ii) Spirality of the oviduct

Albumen secreting folds on the inner surface of oviduct show $2\frac{2}{3}$ times of rotation of dextral spiral through an oviduct, the first spiral begins at infundibulum and ends at middle region of albumen secreting region, the second one begins in connection with the first one, and ends at anterior part of isthmus, and the third one begins there, and ends, without completing a spiral, at anterior portion of uterus (Figs. 4, 5, 18, 21, 22)

Longitudinal muscular tissue of the oviduct also runs dextrally. Direction of spiral of the fold and muscular tissue in an abnormal oviduct with a well developed right oviduct, also was the same as that of normal one (Chishima '31, and Yagi and Chishima '32) (Fig. 21). As has been mentioned above, the spirality of the avian oviduct is a chief determining-factor of spirality in the bird eggs.

(iii) Orientation of the hen's egg at the laying time

In many ornithological books with the exception of Romanoff's famous book ('49,) it has been described that the eggs of wild birds are laid blunt end foremost. But the results of the author's (Chishima '31 b, c) observations on the 194 eggs from White Leghorn hens, and 125 eggs from Nagoya breed hens indicated that in White Leghorn breed the 81.19 per cent of eggs were laid sharp end foremost, and 18.81 per cent were laid blunt end foremost. While, in Nagoya breed 74.4 per cent were laid sharp

end foremost, and 25.6 per cent were laid blunt end foremost. The higher percentage of eggs laid blunt end foremost in Nagoya breed-eggs than White Leghorn-eggs is due, mainly, to the smaller value of shape index (length/breadth) in Nagoya's eggs than that of White Leghorn (Table 1).

Relation between the shape index mean, standard deviation and coefficient of deviation) and the orientation of eggs at laying in White Leghorn and Nagoya breed was described as above; (Table 1).

Table 1

	Breed and no. of egg	Orientation	Mean	S. D.	C. D.
Shape	Wh. L. 194.	Sharp	1.389 ± .007	.085 ± .005	6.141 ± .252
		Blunt	1.354 ± .013	.065 ± .005	4.801 ± .335
index	N. b. 125.	Sharp	1.311 ± .008	.079 ± .006	6.064 ± .448
		Blunt	1.297 ± .018	.100 ± .012	7.710 ± .995

Abbreviations : no, number of eggs observed; Wh. L, White Leghorn ; N. b, Nagoya breed ; Sharp, eggs laid sharp end foremost; Blunt, eggs laid blunt end foremost. (coefficient of deviation) and the orientation of eggs at laying in White Leghorn and Nagoya breed was described as above; (Table 1).

It is certain that the relatively round eggs are apt to be reversed its orientation in the uterus.

(iv) Spiral pattern of egg shell and shell membrane

Sometimes, there appear spiral wrinkles on the surface of hen's egg shell at the sharp end of it (Fig. 20). And the author observed in a certain instances the calcareous depositions on the outer surface of hen's egg shell at blunt end. Normal shell membrane at the sharp end of egg usually shows spiral pattern (Fig. 19). The author observed a spiral shaped calcareous deposition on the outer surface of abnormal shaped egg in turkey (Fig. 21).

Furthermore, there are very beautifully pigmental streaks on the surface of egg shell in wild bird, *Embriza cioides ciopsis*.

(v) Periodic wrinkles and spiral crack on the dried film of egg albumen and serum.

If waterly albumen of hen's egg was poured into the petri-dish and was left dry, then there appears periodic wrinkles and then arises trifurcate cracks at the peripheral part of the dried film. These cracks proceed toward the inner part of the albumen, and give rise to numerous microscopic polygonal areas surrounded by the crack lines which appear at under surface of the film. Within the each of these areas arises a bright and round area resembling, somewhat, a cell-nucleus. That area is a delayed part in gelation

(by drying).

With the advance of gelation of albumen, an arc shaped crack arises abruptly on the peripheral part of the bright and round area, and it advances periodically toward the center of that area, and at last it becomes a spiral crack (Fig. 24).

The spiral crack arises at the lower surface of gelated film and does not reach on the surface of the film. Number of times of rotation of spiral of the crack increase with the increase of thickness of albumen layer. Some times it attains to ten or more times. In the same dried film of albumen from an egg both of dextral and sinistral cracks are observed by about the same frequency, that is, sinistral 50.97 percent vs. dextral 49.03 per cent. The spiral cracks described above take its appearance on the dried film of hen's egg albumen, and also on that of other domestic or wild birds. But the patterns of the cracks in these animals show each of their species specific pattern owing probably to the difference of physico-chemical composition of egg albumen. (Fig. 25).

The pattern of spiral crack can be artificially modified by addition of yolk or other chemical substances or by changing the container of egg albumen, or surface-textures of container. (b) Spiral crack of dried film of blood serum. The author ('35 e, f, g) found that the dried film of the blood serum from horse, cow, pig and human being also gives rise to spiral cracks resembling but somewhat differing from the crack of hen's egg albumen. (Figs. 26, 27). Patterns of these cracks of the blood serums in different animals also show species specifics as in the case of egg albumen, and they also differ with chemical composition, texture of container, and with the thickness of the film.

From these facts it seems to me that there is some possibility to apply the above described patterns of cracks for discrimination of minute difference in chemical composition of blood serum from normal or pathological conditions. After the author's publication, in 1935, on the spiral cracks of egg albumen and of blood serum, the author learned that Ostwald ('30) had already described in a few words as to the spiral crack in dried film of hen's egg albumen. But his description is very brief as that of Romanoff A. L. and A. J. Romanoff ('49). And, so far as I am aware, there is no publication on the spiral crack on the mammalian and human blood serum.

Chapter I

Temperature effect upon the velocity of spiral movement and respiration and its sexual differences in aquatic insect, *Eletes sticticus*, L.

(1) Velocity of respiration and its temperature characteristics

Relationship between the frequency of the appearance of the insect (*E. s. L.*) (Fig. 28.) onto the surface of water (for taking of fresh air), an temperatures, almost satisfy the experimental formula given by Arrhenius for the relationship between the velocity of chemical reaction and the temperatures. And the value of temperature characteristics (μ) was given 1735 at moderate temperatures, 14° to 27°C, and from this value we can presume that the phenomenon is under the control of oxydation. While at high temperatures, 32°-42°C the value of μ was given 4500. (Figs. 6, 7). Such a very low value of μ at the higher temperature range may be attributed the disturbance in normal respiration by the effect of higher temperature (Chishima '29, '30a,).

(2) Spiral movement and temperature

At the moderate temperature-range *Eletes sticticus* L. swims spirally upward and downward, around vertical axis between the surface and bottom of water. Direction of spiral movement of the insects is controlled at their own will, so that an insect often turns the direction, from dextral to sir

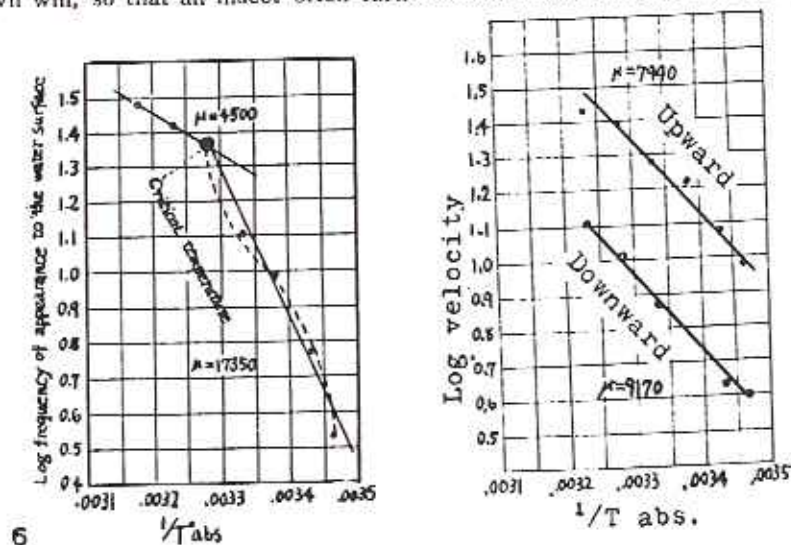


Fig. 6. Temperature effect upon the frequency of the appearance of an aquatic insect (*Eletes sticticus* L.) on the surface of water to take in fresh air.

Ordinate: logarithm of the frequency of appearance. Abscissa: reciprocal of the absolute temp. $\times 10^4$. dotted line: wave tendency of the logarithm of frequency, (From Chishima '29)

Fig. 7. Relation between the velocity of the spiral swimming and temperature in the insect (*E. S. L.*).

Ordinate: logarithm of the velocity of the movement. abscissa: reciprocal of the absolute temp. (From Chishima '29)

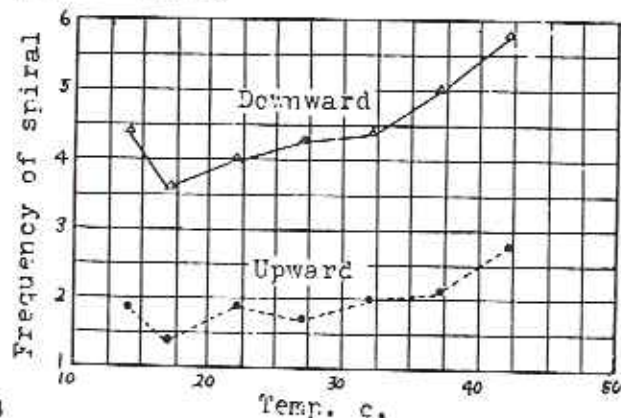


Fig. 8. Temperature effect on the frequency of spiral swimming movement, in *Eletes sticticus* L.

Ordinate: frequency of spirals completed during upward or downward movement to reach the surface or bottom of the water for respiration. Water depth was 33 Cm. Abscissa: temperature C. (From Chishima '29)

stral or reverse during the way. Spiral movement of *E. s. L.* is not a forced movement, because the insect shows no noticeable bilateral asymmetry of body or legs, therefore, it is rather due to more active movement of the legs of one side than that of opposite side. Number of spirals completed in 33 cm. water depth, through upward or downward movement, increase in number of times with the rising of temperatures, (Fig. 8). Thus the steps of spirals become shorter with the rising of temperatures.

(3) Spiral movement and oxydation

Relation between the velocity of spiral movement and the temperature of water in this insect (*E. s. L.*) satisfies the Arrhenius' formula and the value of μ in upward movement was given 9170 at temperatures ranging 14° to 37°C (Fig. 7). Accordingly it can be seen that this phenomenon also is in control under oxydation.

(4) Arrhenius formula and wave of present data

As Arrhenius formula is a form to express a data by a straight line. if we plot the data according to the formula, we will obtain an idealized straight line within an optimum temperature range. However, we know that actual points plotted from the data, fluctuate around the idealized line, and if we connect these dots (points), we will obtain a wavy curve around the idealized straight line. (Fig. 6).

(5) Temperature characteristics and sexual difference in asphyxiation

Studies were carried out on the relation between the asphyxiation caused by anaerobiosis (buried under the water, and shut off air) in *E. s. L.* And the following results were obtained.

The animal vomitted out a blackish substance from its mouth when it is about to fall into asphyxiation. There can be seen a sexual difference of the pose in syncopic state, the female animals extend its fore wings at right angle to the long axis of body, while the most of males do not show such a pose under the moderate temperature range. (Fig. 28). But under very low temperature (8°C), both of the female and male animals fall into syncopic state with a pose shutting together their fore wings. In asphyxiation, hind legs become rigid, and stretch backward parallelly or crossing the both left and right hind legs.

Asphyxiated animals restore their life, when they were exposed to fresh air. When the experimental animals are asphyxiated at temperature 20°C, the time required to restore their life was differed with the temperatures at which the experimental animals previously lived. That is, the average time required to restore their life was shorter in the animals lived previously at lower temperature (under than 14°C) than that of animals lived at a higher temperature (higher than 27°C). The average time required to recover was given 7 min. 11 sec. in female, and 8 min. 11 sec. in male animals (at temperature range 5°-28°C). All the females which have elapsed 25 minutes or 30 minutes after asphyxiated at 27°C, restored their life when they were returned to the normal condition, but all of male animals did not recover and died under the same condition.

It is very interesting that even if the experiment is carried out at the definite temperature of water, viz. 20°C, the effect of it differs by relative degrees of temperatures at which the experimental animal lived before the experiment, that is, when the animals were brought about from higher tem-

perature condition into an lower experimental temperature they fall into asphyxiation faster than the animals which lived previously at lower temperature than the experimental temperature. This fact may be considered as an important finding with a deep significance as to the studies on the temperature effect upon the physiological process.

The fact that the female animals (*E. s. L.*) recover from asphyxiation faster than males also seems to be an interesting finding.

(6) Wave of velocity curve in asphyxiation

The logarithm of velocity of asphyxiation at temperature ranging from 3°C to 10°C decreases rapidly with rising of temperature and becomes minimum at about 14°C, and then gradually increases in velocity at temperature ranging from 14°C to 41°C, and then suddenly increase at temperature ranging from 41°C to 45°C. Average time required to fall the animals into asphyxiation at the temperature range described above, 29 min., 08 sec. with females and 31 min., 31 sec. with males, that is, the female animals fell into asphyxia faster two minutes than males.

(7) Arrhenius' formula and asphyxiation phenomenon

The data from the asphyxiation phenomenon at temperature ranging 14°C to 45°C in *E. s. L.* satisfied the following formula given by Arrhenius for the relation between the velocity of chemical reaction and temperature;

$$\frac{K_2}{K_1} = \frac{\mu}{e_2} \left(\frac{1}{T_1} - \frac{1}{T_2} \right)$$

The constant (μ), the so-called temperature characteristics from the present data were given as follows;

20280 in female; 18440 in male, (at temperature 41°C to 41°C); 102840 in female, 130230 in male (at temperature 41°C to 45°C); (Figs. 9, 10).

Arrhenius formula is a form to express the data as an idealized straight line. But it can be applied only within a confined temperatures ranging 14°C to 41°C, and gives only one value of μ within that range. But if we draw a curve connecting each of plotted points we will obtain a wavy curve. Along that curve we can estimate, further, five or seven of constants (μ) (Fig.12.)

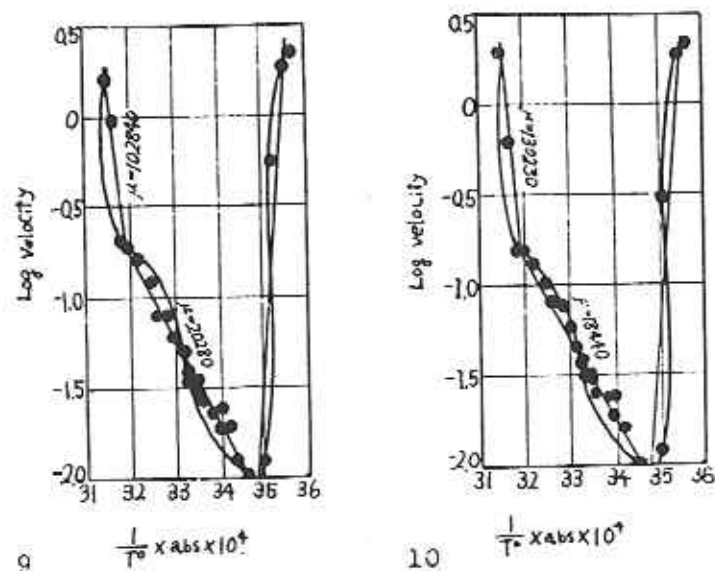


Fig. 9. Temperature effect on the velocity of asphyxia in the male *E. s. L.*

Ordinate: logarithm of velocity, The velocity was expressed by time in minutes required to fall into a syncopic state by asphyxia. abscissa: reciprocal of absolute temp. $\times 10^4$. (From Chishima '30a)

Fig. 10. Temperature effect on the velocity of asphyxia in the female *E. s. L.*

Explanation of ordinate and abscissa is the same as the Fig. 9. (From Chishima '30a)

(8) Asphyxiation and nutrient condition

The average time that the animals fell into asphyxiation differed with their nutrient conditions, that is the well-fed animals required about five minutes more than the animals fastened for two days before the experiment by the time they fall into asphyxiation.

(9) Syncopic states and chemical reactions

Out of the form of curve and the value of μ of syncopic state at temperature ranging from 3°C to 45°C in *Eletes sticticus L.*, it can be assumed that the phenomena involves three different systems of chemical reactions that is, (i) the syncopic state at temperature 3°C to 8°C may be due to the loss of muscular contraction under extreme low temperature, since it does not satisfy Arrhenius' formula; (ii) the syncopic state at temperature 14

to 41°C may be considered as a result of asphyxiation of the animals, because its average value of in both sexes was given 19360, and this value approximately coincide with the characteristic value of μ in oxydation; (iii) The temperature characteristics of asphyxiation at temperature 41° to 45°C were given 116540, that is somewhat smaller than the value of μ estimated by the other investigators (Yagi and Koizumi '29) from the data of heat death

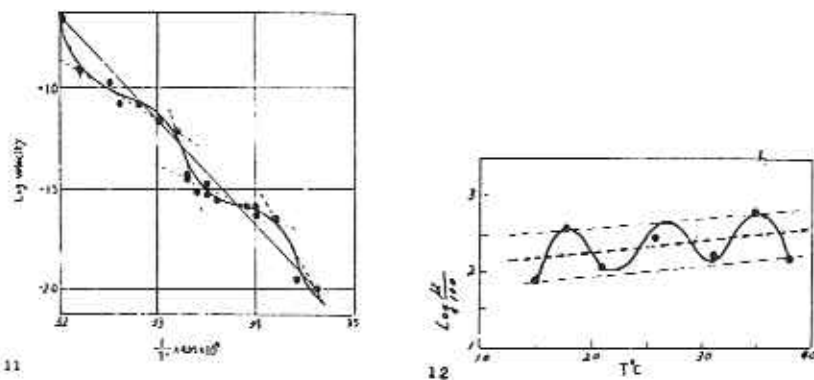


Fig. 11. Graph showing in magnified form and in modified manner (modification of the relative proportion of the length between the ordinate and the abscissa from the data of the curves in Figs. 9,10 ranging from 32 to 35 in temperature ($\frac{1}{T_0}$ abs $\times 10^3$). It will be seen that the relationship between the logarithm of velocity of asphyxia and the reciprocal of the absolute temperature $\times 10^3$ is an undulating curve and not a straight line. Broken lines show that there are several trends with different values of temperature characteristic in that phenomenon. (From Chishima '30a)

Fig. 12. Graph indicates the effect of temperature upon the value of μ of asphyxia in *E. s. L.* It will be seen that the curve is rhythmical, resembling to a sine curve. (From Chishima '30b)

of other animals, on the contrary, it is extraordinarily larger than that of already established value of oxydation in living things. Therefore, this phenomenon is, certainly, due to the death of animals by extremely high temperature, accompanied with some influence of asphyxiation. Temperature characteristics of the velocity of syncope phenomena in *E. s. L.* at temperature 45° to 59°C was given 140120, that value is so high that the phenomenon may be considered as a result of a heat-death (or syncope state) in the animals.

(10) Factors regarding the loss of locomotive ability by asphyxiation

Loss of locomotive ability by asphyxiation in *E. s. L.* is probably due to the oxygen debt of muscular tissue, and to the accumulation of lactic acid and CO_2 in the muscles. Asphyxiation and syncope state under extremely low temperature may be caused by paralysis of nervous system and muscular tissue. On the contrary, heat death may have relation to the denaturation of myoprotein because the value of temperature characteristics of this phenomenon ($\mu = 141120$ at 45° to 59°C) resembles that of protoplasm-coagulation by heat.

(11) Consideration of the mechanism in sexual difference of asphyxiation

As described above the female animals fall earlier into asphyxiation, and they recover, rapidly, from that state than the males in *E. s. L.* This fact is, probably, due to the sexual difference in activity of peroxydase or other respiratory enzymes.

(12) Krough's formula and the present experiments

From the results of the present studies on the behaviour and asphyxiation in *Eletes sticticus L.*, it can be said that though we can see the general trend of the physiological process by means of Krough's straight line-formula as to the relationship between reaction-velocity and temperature, it can be applicable only to a certain limited temperature range. If we express the data as a straight line according to Krough, we can point out the possibility of drawing a wave curve by tracing the actually measured points around the straight line.

(13) Belenharadek's formula and the present experiments

Experimental formula given by Belenharadek also belongs to a category of the form expressing by straight line. So that, his formula also accompanies with the same defect as described about the formula of Krough ('14).

(14) Law of Q_{10} and present data

Law of Q_{10} advocated by vant Hoff implies deep significance, because it indicates that the velocity of vital phenomena increases about two to three times with increase in every ten degrees of temperature within optimum temperature range. However, if we estimate Q_{10} at more narrow temperature ranges than ten degrees, we should be able to obtain several of Q_{10} -values. By such a method the author obtained actually several of Q_{10} -values from the author's data of asphyxiation in *E. s. L.*, and a wave curve

was obtained by plotting these values (Chishima '30b).

(15) *Arrhenius' formula and straight line*

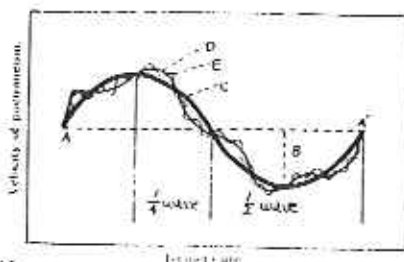
Experimental formula given by Arrhenius also regards the straight line as an ideal form of expression of living process. In this respect this formula also neglects the small waves included in the straight line as described before.

(16) *Janish's formula and present data*

"Kettenlinie theorie" advocated by Janish ('27), resembles the writer's opinion that lays a strong emphasis upon wave-expression. However, his formula (Kettenlinie reziprobe), $\frac{1}{y} = \frac{m}{2} a^x + a^{-x}$ also, can neither explain nor include the author's data obtained from the asphyxiation at higher temperature range.

(17) *The author's method regarding the expression by wave line*

From the results of the present experiments, it can be said that the relationship between the velocity of asphyxiation and movement at temperature ranging 3° to 45°C in *Eletes sticticus* L. can not be expressed by a simple mathematic formula. Therefore, the author presented a form to express the data as a wave curve (Figs. 11, 13). This form of expression is desirable to use together with the method expressing by straight line. The present author's method, of plotting, is as follows, (i) draw the lines of axis of X and Y so as to become equal length as far as possible, (ii) take ex-



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Fig. 13. A schematic representation of the effect of temperature upon the periodic oscillation of intensity (or velocity) curve of physiological process. It will be seen that the larger sigmoid curve (C), the principal wave line includes further in it the more smaller wave line (D), and (E). A-B, wave length of curve C. B,

perimental data at wide temperature range, (iii) measurement must carried out as possible as small steps at small temperature ranges, and (iv) draw the curve in fairly large scale.

If we plot the data by this method we shall obtain the first, second or higher grade (smaller) wave (Fig. 13.) The author believes that by this manner of expression we can perceive the characteristics of each physiological phenomenon. And this method may have, further an advantage to avoid the counteraction

amplitude of wave C, C, principal wave, D, second wave, E, third wave. Ordinate: intensity or velocity of physiological process) abscissa: temperature. (From Chishima '30b)

of individual characteristics. That is to say, individual characteristics is apt to be counteracted by each other by taking an average value from many individuals.

(18) *Meaning of wave and spiral*

After all, the author demonstrated the following fact in the chapter I, that if the relationship between the velocity of reaction and temperature is plotted in section paper, its curve is principally wave in nature, and, so far as the curve is drawn on the paper it is, of course, in two dimensions but if we suppose it is in three dimensions, stereographically, the wave curve can be regarded as an abstractive spiral. And that spirality of the life phenomenon and asymmetrical, wavy and spiral patterns in the living world described above are in accord with dialectic point of view, especially, with the doctrine of oriental philosophy, the psycho-somatic dialectic (mind and body; or spirit and material are inseparably united as an unity).

(C) Summary

Studies on the asymmetrical, wavy and spiral patterns in the bird's egg, oviduct, dried film of egg albumen, mammalian serum, (chapter I), and in the relationship between the physiological processes (spiral movement and asphyxiation) and temperatures in an aquatic insect, *Eletes sticticus* L. are performed (chapter I). The results obtained are summarized as follows;

Chapter I

- (1) The author has studied on the hen's egg-structure, with special reference to the asymmetry, periodicity, and spirality of it. And the present author found that the diagrammatic illustrations of hen's egg, which have been accepted widely as a standard diagram of hen's egg, disagree, in many points, with the results obtained from the present studies.
- (2) Hen's egg shows asymmetrical structure in the following points, (i) polarity of yolk, (ii) shape of egg and yolk with length and breadth, (iii) position of germinal disk, (iv) position of air chamber, (v) distribution of pore canals on the egg shell, (vi) altitude of attachment of chalazae at opposite side, (vii) origin and mechanism of the above-described asymmetry in the egg are discussed.
- (3) Results of studies on the periodic pattern in the hen's egg described in the following subjects, that is, (i) egg shell is composed of several of

periodic layers, the cuticle layer, two spongy layers, and of four or more mammillary layers, (ii) shell membrane is composed of three layers, the outer, middle and inner layer, (iii) several of thick albumen layers, (iv) several of white and yellow yolk layer.

(4) The spirality of bird's egg and of oviduct is described, with special reference to the following points, (i) structure and spirality of chalazae and its origin, (ii) mechanism of chalazae formation and the region of oviduct at where the chalazae is formed, (iii) spirality of folds of mucous membrane and of longitudinal muscular tissue of the oviduct, and intimate relationship between the spiral movement of oviduct and spiral pattern of hen's egg, especially the spiral pattern of egg shell, shell membrane, thick albumen and chalazae, (iv) orientation of hen's egg at egg-laying moment, and its relationship to the shape index (length breadth) of egg, (v) the author found that there appear numerous microscopic spiral cracks on the under surface of the dried films of mammalian serum and bird's egg albumen.

Chapter I

In the chapter I the present author described the results of studies on the temperature effect upon some of physiological processes, especially the velocity of spiral movement and asphyxiation and their sexual difference in aquatic insect, *Eletes sticticus* L. Summary of the results is as follows.

(1) At optimum temperature, the animals swim spirally and vertically in the water. And the temperature characteristics of the velocity and frequency of these behaviours are given at the temperature ranging 14 to 42°C. From the numerical values of the temperature characteristics of these phenomena, it was estimated that these behaviours, at moderate temperature, are under the control of oxydation, but at higher temperature range, it may be attributed to the disturbance of the physiological process.

(2) Wavy curves were obtained by plotting the datum obtained from the relations between temperatures and the following subjects; (i) velocity of spiral movement, (ii) frequency of appearance on to the water surface, (iii) velocity of asphyxiation in the male or female animals, and there can be seen sexual difference of it.

(3) It was found that, even though the animals are exposed to a same temperature, its effect differs according to the previous temperature conditions at which the animals lived, that is, the animals being brought about from the lower temperature than a definite experimental temperature they fall more rapidly into asphyxiation than those from at higher temperature.

Accordingly it can be said that the relative intensity of temperatures must be considered as an important factor when an experiment concerning temperature effect on the organisms is carried out. And the average time required to restore the life from asphyxiated condition was faster in female than in male.

(4) Mechanism regarding the asphyxiation, spiral movement and the other behaviour in *Eletes sticticus* L. was discussed. And the experimental formulas given by Arrhenius, Krough, Belenharadek, vant Hoff and others were also discussed in comparison with the author's method expressing the data as a wavy curve.

(5) After all, from the results of studies described in the chapter I, it is concluded that the result obtained from the studies on the relation between the physiological phenomena and temperature in *Eletes sticticus* L., did not necessarily satisfy the experimental formula given by Arrhenius and the others though the experimental results obtained at optimum temperature range, satisfied them.

It can be said that even though the straight-line formulas given by Arrhenius and the others are convenient to know the general trend of the phenomena, it can not satisfy the data from further wide temperature range, that is, at higher or lower temperature than the optimum temperature. Moreover, the formulas expressed by an idealized straight line are apt to neglect the small waves undulating around the straight line.

(6) All data described in the chapter I ~ III are coincide with dialectical point of view, especially, with the oriental way of looking at things from ancient times, the psycho-somatic dialectic.

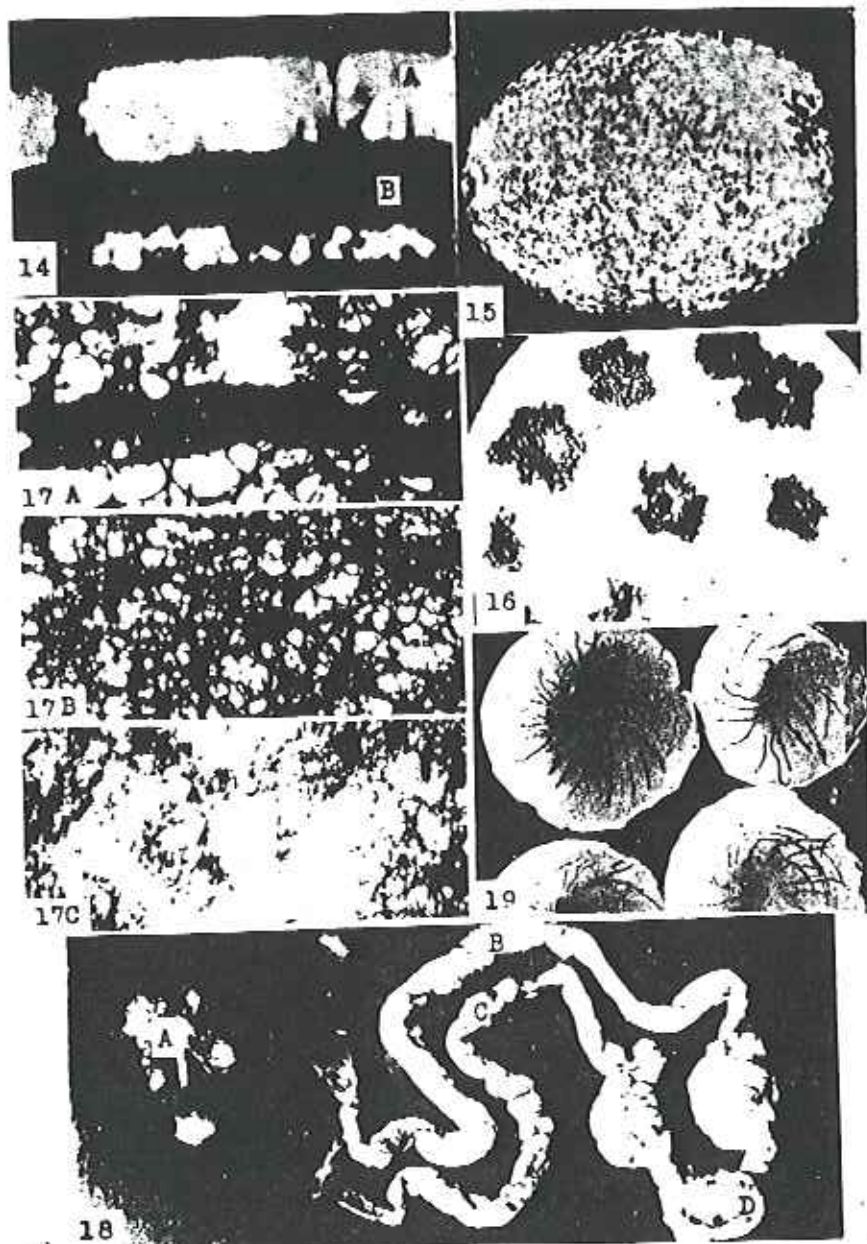
In conclusion the author wishes to express his obligation to prof. N. YAGI Prof. H. UDA; Prof. T. HATAI, and Prof. H. ITO to whom the author is indebted for valuable suggestion and kindly advice.

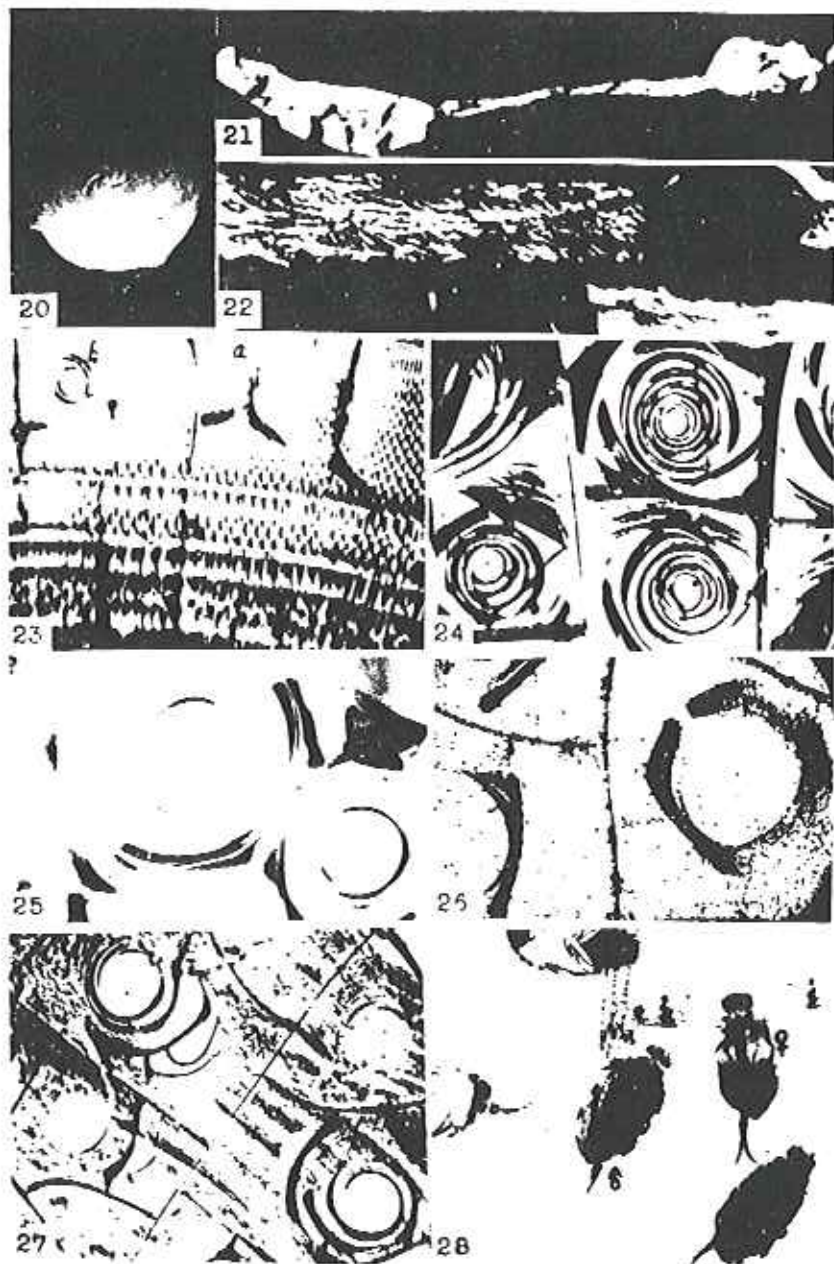
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Explanation of Figures

Plate I

- Fig. 11. Microphotographs of radial sections through the two hen's egg shells. The upper one (A) shown the two pore canals, and one of which is branched off. The lower one (B) shows periodic pattern in a burned egg shell; upper most bright layer—cuticle and upper spongy layer; middle dark layer—lower spongy layer; the most lowest bright layer—mammillary layer. $\times 45$ (From Chishima '35a)
- Fig. 15. Asymmetrical distribution of the pores on the hen's egg shell. Alcohol solution of methylen blue was dropped on the inner surface of the shell to make clear the pores openings on the surface of dried hen's egg shell. Darker area is opaque area; brighter portion is the more translucent spots. $\times 1.2$ (From Chishima '35a)
- Fig. 16. A magnified portion of Fig. 15 showing eight pore openings covered with cuticle and organic matter. Existence of the pore's opening can not visible without applying the diffusion-staining method. $\times 130$ (From Chishima '35a)
- Fig. 17. Microscopic structure of the three layers of shell membrane of the hen's egg: 17A, outer; 17B, middle; 17C, inner shell membrane $\times 800$ (From Chishima '35a)
- Fig. 18. Abnormal oviducts of a hen. Right oviduct (C) is well developed even it is somewhat smaller than the left one (B). Foldings of the mucous membrane were twisted dextrally in the both oviducts as normal one. $\times \frac{1}{4}$. A, ovary; D, cloaca. (From Chishima '31c)
- Fig. 19. Spiral wrinkles of the normal shell membrane on the inner surface of the hen's egg shell at the pointed end. In order to clarify, the wrinkles were traced with ink. $\times \frac{3}{4}$ (From Yagi & Chishima '32)

Plate II

- Fig. 20. Spirality of birds eggs. Spiral wrinkles on the outer surface of hen's egg shell at the pointed end. $\times \frac{3}{4}$ (From Yagi & Chishima '32).
- Fig. 21. An abnormally elongated and connected turkey's egg with soft shell which is twists

dextrally. $\times \frac{1}{2}$ (From Chishima '31e.)

- Fig. 22. Hen's oviduct slit longitudinally, and laid open showing dextral spiral folding of the mucous membrane of the oviduct. (From Yagi & Chishima '32).
- Fig. 23. Microscopic pattern of the periodic wrinkles and the cracks on the dried film of hen's egg albumen. At an early stage of drying there appear the periodic wrinkles, and the polygonal crack areas at the periphery of the albumen gel. In the each of these areas then arises a clear, round areas (a), and then spiral crack (b), make its appearance abruptly at the peripheral part of the round clear area, and the spiral crack advances periodically toward the center of the area. (cf. Fig. 24) $\times 50$ (From Chishima '35 c, f)
- Fig. 24. Microphotograph showing the spiral cracks appeared within each of the polygonal shaped cracked areas at under surface of the dried film (gel) of hen's egg albumen. $\times 80$ (From Chishima '35c, d, f)
- Fig. 25. Spiral cracks of the dried films of egg albumen of a wild birds, *Emberiza cioides ciopsis* ($\times 85$) (From Chishima '35f).
- Fig. 26. Microscopic pattern of spiral cracks on the dried films of human blood serum $\times 100$. (From Chishima, unpublished data)
- Fig. 27. Spiral cracks of dried film of pig's blood serum. ($\times 60$) (From Chishima '35f).
- Fig. 28. Sexual difference in the poses of dead animals (*Elotes sticticus* L.) induced by asphyxiation. The female animals extend the fore wings, while the most of males does not extend it. (From Chishima '30a)

II Asymmetrical Development of the Urinogenital Organs and its Relation to the Sex-differentiation in the Chick Embryos *

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Introduction

Since the asymmetrical development of the gonad and its relation to the sex-differentiation in the chick embryo was first described by Semon (1887), the problem has been studied further by several workers (Firket, '14; Swift, '15; Lillie, '19; Minoura, '21; Greenwood, '24-'25; Willier and Yuh, '28; Brode, '28; Witschi, '34; '35; Chishima, '51, '52, '57, '58 and the others).

However, the following problems are not yet well established namely-(i) asymmetrical development of the urinogenital organs through the whole developmental stages in the chick embryo, (ii) intimate relationship among the development of the gonad, Wolffian body and Müllerian duct, (iii) at what stage the first and the secondary sexual characters take their appearance in the chick embryos. In the present paper the writer describes the results of studies on these problems.

Material and Methods

225 F, chick embryos obtained by crossing female Barred Plymouth Rock with male Rhode Island Red were used as material. Age of embryos ranged at 4 ~ 21 days of incubation. Under the microscope, the growth in size of urinogenital organs were measured in length, breadth and projected area by means of micrometer and camera lucida. The projected area of the gonad or Wolffian body was drawn at first, with camera lucida, and the area was measured by planimeter. And then the value of projected

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area was divided by the magnification power, thus the true values of the projected areas of these organs were given in square centimeter.

To make clear the border lines of each urinogenital organs, Bouin's fluid was dropped on the surface of these organs after an incision had been made in abdomen and after the viscera had been removed from the embryo. In some cases histological studies of the gonad were carried out to know the relationship between microscopic structure and the macroscopic shape of the gonad. Method of histological study was same as that described in the writer's previous reports (Chishima '51, '52).

Results

(A) *Asymmetrical development of the gonads with special reference to the sex-differentiation in chick embryos.*

(1) *Shape and position of gonads and sex-differentiation*

As has been generally known, the primordia of gonads first occur in chick embryo on the inner sides of both right and left Wolffian bodies as a pair of yellowish white wrinkle or fold at the 4 days of incubation (fig. 6). These left and right side primordia gradually part from each other (figs. 7, 8) but up to the embryonal age at 5 days of incubation, it is still impossible to foretell the sex of the embryo since the gonads developed to an equal degree in all embryos. (fig. 7)

However, at the 7th day of incubation, discrimination of the sex of the embryo is practically possible by the bilateral asymmetry in the female gonads (figs. 9, 10).

At the same age, the anterior end of the right gonad in the male bends toward the outer side, and its posterior end bends toward the inner side of the right Wolffian body. So that the right testis seems somewhat S-shaped (fig. 9), while the left gonad still runs parallel approximately to the long axis of the body, though there is no significant difference in the sizes of the left and right gonad in the male.

On the contrary, the gonads in the female at the 7th day of incubation show tolerably a bilateral asymmetry in size and shape of gonads. So that, in general, the left side predominance in the female gonads is fairly evident. (tab. 1, 2 fig. 10).

However, in the present material, it was found that the discrimination of the sex by the asymmetry in size and shape of gonads in the female is not decisive, because there were observed some exceptional cases, in which the gonads showed an asymmetry (size index, $L/R = 1.88$ or 1.64), while

according to the result of histological examination, they showed a characteristic structure of the testis.

Accordingly, sex of the chick embryo can first be told exactly by means of histological technique at the embryonal age at 9 days of incubation when the distended medullary cords first take their appearance in the ovary only (cf. Chishima '52 and figs. 33-36).

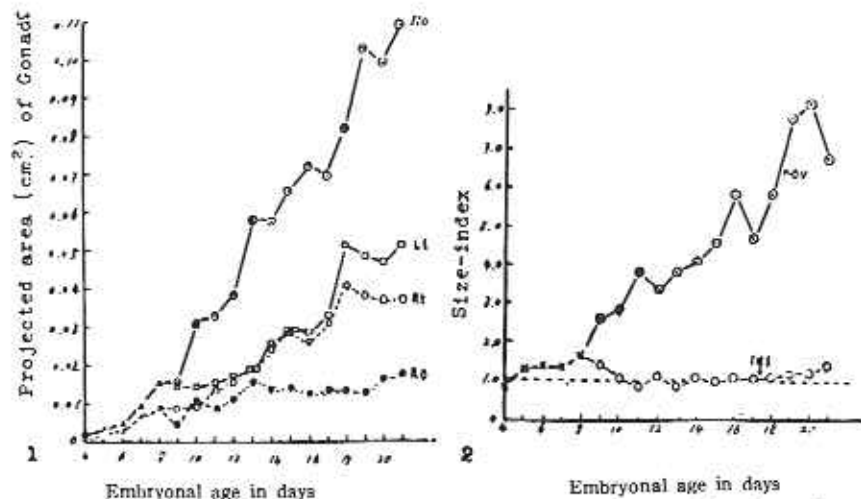


Fig. 1. Growth curves of the gonads in projected area (cm²) in the chick embryos, data from table 1.

Note : Lo.....Left ovary, Lt.....Left testis,
Ro.....Right ovary, Rt.....Right testis

Fig. 2. Size-indices (L/R) of the embryonal gonads in the chick embryos, data from table 1.

It is a noteworthy fact that the gonads obtained from untreated or normally incubated embryos often show a very wide variation in shape, especially on the right gonad in the female. Accordingly, it is necessary for the experimental investigators to take this fact into consideration because such an abnormal form of the gonad under normal condition of incubation is apt to be misunderstood as an effect of treatment such as the injection of sex hormone into the developing egg.

The results obtained from the present observation on the growth in the projected area, length and breadth of the gonad are given in table 1-3 and figures 1-3, 6-32.

Figure 1 shows the curves of development of gonads. It is evident

that the left ovary shows the most rapid growth and the second is the left testis, the third is the right testis and the last is right ovary which still persists as a rudimentary organ at the hatching (fig. 31). It is also a noteworthy fact that all those four curves exhibit generally the same feature; the irregular waveness,

Size indices of the ovary clearly exhibit the left side predominance throughout the whole embryonal life, but in the male gonad, this tendency is smaller in degree, than in the female. Thus there can be found only a slight evidence of the bilateral asymmetry in the testes (tab. 1 and fig. 2). Frequency of the asymmetry in the testes was as follows; L:R=76.7%

L:R=15.6 and L:R=7.7% (tab. 3).

(2) *Melanin pigmentation on the surface of the gonad*

In the present material it was observed that the 34 testicles on which melanin pigment deposited, were found in 26 embryos out of 126 embryos. The melanin pigmentation first occurred on the testis' surface at 14 days of incubation and it increases in the intensity and the frequency of occurrence with the embryonal ages. Melanin pigmentation occurred most frequently on the anterior half of the left testis (tab. 4).

The left and right ratio in the intensity and the frequency in the occurrence of melanin pigmentation on the 34 testes out of 126 embryos were as follows, L:R=1:0.7 (in intensity) and L:R=2:1 (in occurrence) (tab. 4). Hence it is clear that the melanin deposition on the testes also shows a left side predominance in its intensity and occurrence (tab. 4). It is very interesting fact that there could not be found the pigmented ovary throughout the all embryonal life.

(B) *Development and retrogression of the Mullerian duct*

As has been generally known, the Mullerian duct first appears at the antero-dorsal side of the Wolffian body (mesonephros), then it grows extending backward to the cloaca along the outer side of the Wolffian body (fig. 7). As represented in tab. 5 and figs. 3, 6~12, the development of the Mullerian ducts in the both sexes is almost in the same degree up to the age at 8 days of incubation (figs. 11, 12).

In the male, the Mullerian duct attains its maximum size at 9~10 days of incubation (fig. 15), and at the 11 days of incubation the ducts of the both right and left side suddenly disappear at once leaving a whitish cloudy remnant (fig. 17). At the 12th day of incubation this cloudy substance disappears entirely. While, in the female, the right Mullerian duct begins its retrogression at the 9th day of incubation backward from its anterior end

Table 1 Asymmetrical development of the gonad size in projected area (cm²) with relation to age and sex in chick embryo

Age in days	No. of embryo & sex			Size of testis (cm ²)		Size-index of testis (L/R)	Size of ovary (cm ²)		Size-index of ovary (L/R)	
				Right	Left		Right	Left		
4			5	0.0017	0.0016	0.96	In-different stage			
5			5	0.0023	0.0029	1.26				
6			7	0.0031	0.0046	1.48				
7			6	0.0069	0.0095	1.37				
8			10	0.0091	0.0154	1.69				
	♂	♀	total							
9	9	7	16	0.0099	0.0147	1.48		0.0056	0.0145	2.59
10	5	8	13	0.0099	0.0146	1.48		0.0110	0.0315	2.85
11	6	7	13	0.0137	0.0136	0.99	0.0088	0.0335	3.80	
12	11	12	23	0.0159	0.0163	1.03	0.0113	0.0388	3.42	
13	6	9	15	0.0196	0.0191	0.98	0.0155	0.0578	3.87	
14	6	8	14	0.0244	0.0251	1.03	0.0140	0.0572	4.09	
15	5	6	11	0.0293	0.0293	1.00	0.0144	0.0655	4.56	
16	3	10	13	0.0266	0.0287	1.08	0.0124	0.0722	5.84	
17	3	3	6	0.0336	0.0317	0.94	0.0148	0.0699	4.73	
18	5	7	12	0.0401	0.0515	1.28	0.0138	0.0812	5.90	
19	8	4	12	0.0388	0.0490	1.26	0.0130	0.1040	7.91	
20	6	4	10	0.0368	0.0477	1.30	0.0163	0.0962	8.24	
21	17	17	34	0.0369	0.0533	1.44	0.0181	0.1099	6.07	

Table 2 Asymmetrical development of the gonad size in length and breadth in chick embryos with relation to age and sex

Age in days	No. of embryos			Size of testis				Size of ovary				
				Length (mm.)		Breadth (mm.)		Length (mm.)		Breadth (mm.)		
				Right	Left	Right	Left	Right	Left	Right	Left	
4			5	2.37	2.37	0.08	0.08	Indifferent stage				
5			5	2.90	3.20	0.11	0.11					
6			7	2.00	2.46	0.20	0.24					
7			6	1.80	2.00	0.32	0.37					
8			10	2.10	2.60	0.51	0.67					
	♂	♀	Total									
9	9	7	16	2.40	2.60	0.51	0.64		1.69	2.42	0.42	0.72
10	5	8	13	2.00	2.41	0.61	0.68		1.36	3.05	0.59	0.96
11	6	7	13	2.50	2.90	0.60	0.63	2.10	3.68	0.58	1.22	
12	11	12	23	2.70	3.10	0.72	0.72	2.10	3.90	0.71	1.27	
13	6	9	15	3.00	3.30	0.81	0.82	2.71	4.77	0.77	1.51	
14	6	8	14	3.20	3.30	1.03	1.03	2.52	4.74	0.73	1.48	
15	5	6	11	3.40	3.80	0.95	0.93	3.00	5.13	0.72	1.49	
16	3	10	13	3.20	3.50	0.94	0.97	2.49	4.88	0.66	1.59	
17	3	3	6	3.40	3.90	0.94	0.93	2.42	5.92	0.69	1.46	
18	5	7	12	3.40	4.60	1.24	1.38	2.57	5.80	0.63	1.63	
19	8	4	12	4.02	4.60	1.17	1.28	2.65	6.15	0.68	1.99	
20	6	4	10	3.61	4.51	1.19	1.34	2.75	5.92	0.63	1.84	
21	17	17	34	3.65	4.79	1.18	1.32	2.66	6.35	0.71	2.02	

Table 3 Frequency of the occurrence of the bilateral asymmetry of the testis-size (square cm.) in the chick embryos in relation to age and sex

Age in days	Freq.	No. of embryos	L>R	L<R	L=R
9		9	9		
10		5	5		
11		6	5		1
12		11	5	4	2
13		6	2	3	1
14		6	3	2	1
15		5	2	2	1
16		3	2	1	
17		3	2	1	
18		5	5		
19		8	6	1	1
20		6	6		
21		17	17		
Total		90	69 (76.7%)	14 (15.6%)	7 (7.7%)

Table 4 Deposition of melanin pigment on the testes in the chick embryos with relation to age, laterality, intensity and frequency of occurrence

Age in days	No. of embryo	Pigmented testis				Site of melanin deposition								
		Right testis		Left testis		A.h.		Ai.		In.		Al.		
		No. of testis	Intensity	No. of testis	Intensity	R	L	R	L	R	L	R	L	
14	17	0		1	+									
15	7	0		0										
16	10	2	++	2	+++	1	1	1						1
17	9	0		0										
18	24	3	+++	3	++++	2	3			1				
19	9	2	++++	0		1		1						
20	11	0		2	+++			1						1
21	39	7	+++++	12	+++++	2	8	3	3	1	2			
Total	126	14	21	20	44	6	12	6	3	1	2	2	2	

A.h.-----anterior half; Ai.-----anterio-inner side; In.-----inner side;
Al.-----All the surface of testis; R.-----Right testis; L.-----left testis.

(fig. 14).

The right Müllerian ducts in the five female embryos out of eight embryos at the 10th day of incubation retrogressed already to the anterior region of the right ovary (fig. 16).

But the breadth of the posterior portion, especially the shell gland of the right Müllerian duct in the female, does not show a sign of decrease in size even after 13 days of incubation and still continues its growth to

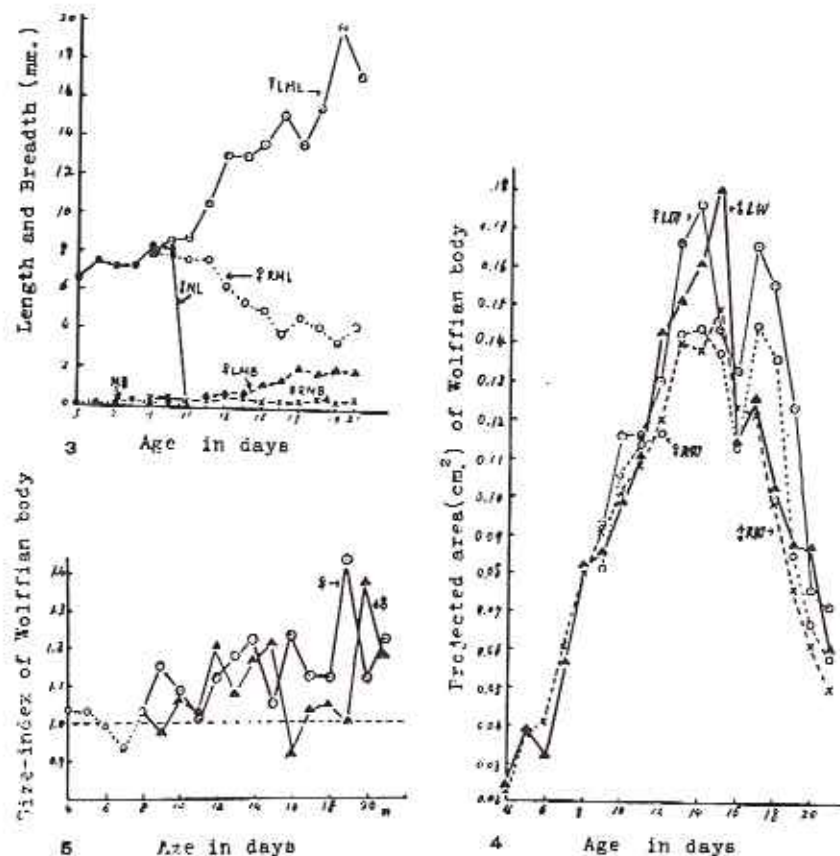


Fig. 3. Growth and retrogression of Müllerian ducts in the chick embryos, data from table 5.

Note: LML-----Length of left Müllerian duct in female;
RML-----Length of right Müllerian duct in female;
ML-----Length of Müllerian ducts in male;
MB-----Breadth of Müllerian ducts in indifferent stage and male;

LMB.....Breadth of the largest portion (shell gland) of left Müllerian duct in female;

RMB.....Breadth at the largest portion of right Müllerian duct in female.

Fig. 4. Growth and retrogression of the Wolffian body in the chick embryos with relation to age, sex and laterality, data from table 6.

Note : LW.....left Wolffian body; RW.....right Wolffian body.

Fig. 5. Size-indices (L R) of the Wolffian bodies in chick embryos with relation to age and sex, data from table 6.

the hatching time (fig. 31). It contracts in length to the posterior end of Wolffian body, at the 12 days of incubation (fig. 20), and then the anterior portion of the duct bends so as to become a hook-like form (fig. 24). The posterior portion of it bulges out and gives rise to the so-called "shell gland". The left Müllerian duct only continues its growth through the whole embryonal life, and afterward it becomes to the functional oviduct in the adult hen (figs. 29, 31).

Table 5. Growth and retrogression of Müllerian ducts in the chick embryos with special reference to age, sex and laterality

Age in days	No. of embryo			Müllerian duct in male				Müllerian duct in female								
	Male	Female	Total	Right (cm.)		Left (cm.)		Right (cm.)			Left (cm.)					
				Leng.	Br.	Leng.	Br.	Leng.	Br.	S. g.	Leng.	Br.	S. g.			
5			5	0.67	0.0078	0.67	0.0078									
6			4	0.75	0.015	0.75	0.015	Indifferent stage								
7			5	0.72	0.018	0.72	0.018									
8			10	0.72	0.025	0.72	0.025									
9	3	6	9	0.82	0.019	0.82	0.018	0.79	0.022		0.790	0.026				
10	3	6	9	0.80	0.026	0.88	0.028	0.73	0.031		0.830	0.028				
11	6	7	13	0	0	0	0	0.68	0.027		0.860	0.028				
12	10	12	22					0.69	0.031	0.4400	1.070	0.031	0.0450			
13	9	9	18					0.61	0.031	0.0475	1.300	0.028	0.0770			
14	5	5	10					0.55	0.033	0.0458	1.200	0.025	0.0775			
15		6	6					0.57	0.028	0.0433	1.380	0.043	0.1190			
16		9	9					0.39	0.028	0.0387	1.470	0.046	0.1600			
17		2	2					0.47	0.033	0.0380	1.550	0.050	0.2000			
18		1	1					0.42	0.028	0.0450	1.550	0.055	0.1810			
19		2	2					0.35	0.025	0.0380	1.580	0.057	0.2040			
21		13	13					0.43	0.031	0.0540	1.690	0.058	0.1870			

S.g. Breadth of Müllerian duct at the largest portion (shell gland);

Leng. Length; Br. Breadth.

The asymmetrical development and the sexual difference in retrogression of the Müllerian duct seem to have a very important biological significance as in the case of the right ovary.

(C) Growth and retrogression of the Wolffian body

Though there is an intimate relationship between the development or the retrogression of Wolffian body and that of the gonad, there has been paid a little attention about this matter.

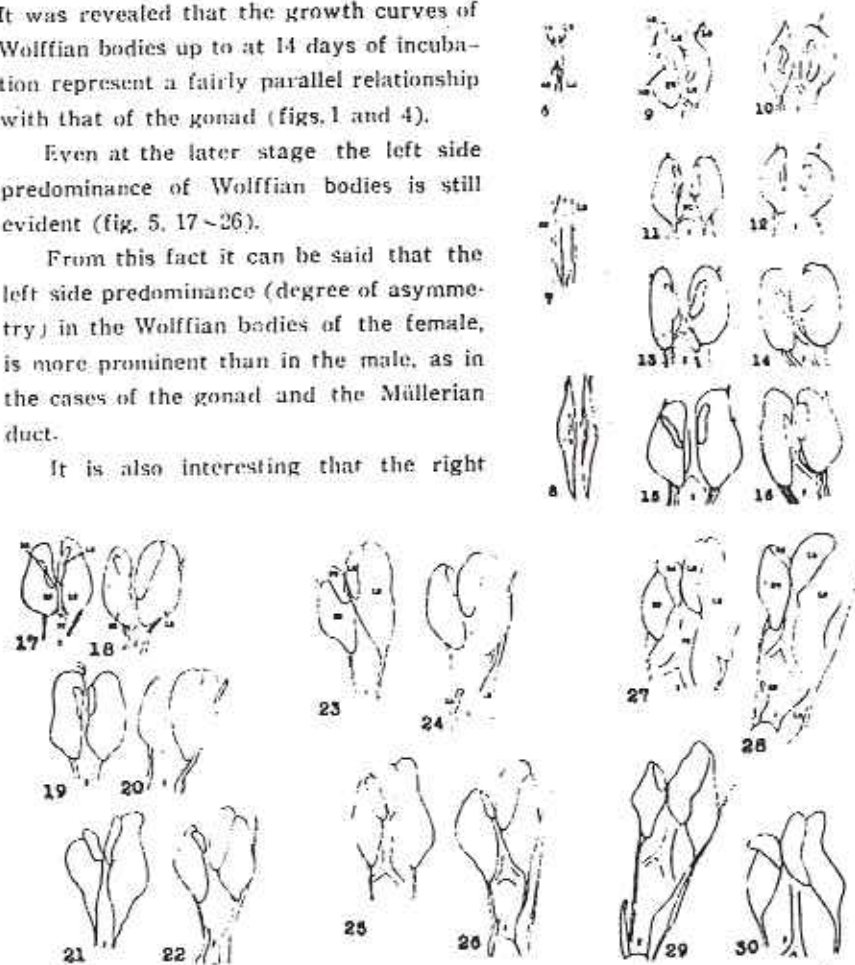
The results of the present studies on the growth, retrogression and size index of the Wolffian body are given in tab. 6 and figs. 4, 5 and 6-32.

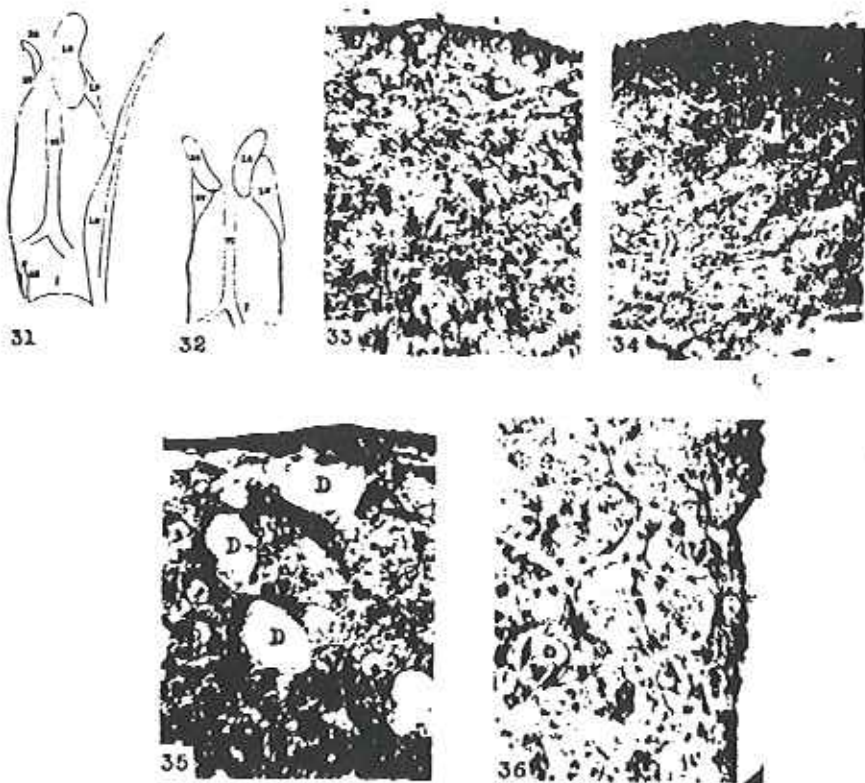
It was revealed that the growth curves of Wolffian bodies up to at 14 days of incubation represent a fairly parallel relationship with that of the gonad (figs. 1 and 4).

Even at the later stage the left side predominance of Wolffian bodies is still evident (fig. 5, 17-26).

From this fact it can be said that the left side predominance (degree of asymmetry) in the Wolffian bodies of the female, is more prominent than in the male, as in the cases of the gonad and the Müllerian duct.

It is also interesting that the right





*Explanation of figures 6-36

Abbreviations

- | | |
|--------------------------|------------------------------|
| LG, left gonad. | RG, right gonad. |
| LW, left Wolffian body. | RW, right Wolffian body. |
| LM, left Müllerian duct. | RM, right Müllerian duct. |
| VC, vena cava posterior. | D, distended medullary cord. |

Fig. 6. Urinogenital system of chick embryo, at 4 days of incubation.

(camera lucida drawing)

- Fig. 7. _____, at 5 days of incubation. × 5
 Fig. 8. _____, at 6 days of incubation. × 5
 Fig. 9. _____, at 7 days of incubation. (♂) × 5
 Fig. 10. _____, at 7 days of incubation. (♀) × 5
 Fig. 11. _____, at 8 days of incubation. (♂) × 5
 Fig. 12. _____, at 8 days of incubation. (♀) × 5
 Fig. 13. _____, at 9 days of incubation. (♂) × 5
 Fig. 14. _____, at 9 days of incubation. (♀) × 5

- Fig. 15. _____, at 10 days of incubation. (♂) × 5
 Fig. 16. _____, at 10 days of incubation. (♀) × 5
 Fig. 17. _____, at 11 days of incubation. (♂) × 2.7
 Fig. 18. _____, at 11 days of incubation. (♀) × 2.7
 Fig. 19. _____, at 12 days of incubation. (♂) × 2.7
 Fig. 20. _____, at 12 days of incubation. (♀) × 2.7
 Fig. 21. _____, at 14 days of incubation. (♂) × 2.7
 Fig. 22. _____, at 14 days of incubation. (♀) × 2.7
 Fig. 23. _____, at 15 days of incubation. (♂) × 2.7
 Fig. 24. _____, at 15 days of incubation. (♀) × 2.7
 Fig. 25. _____, at 16 days of incubation. (♂) × 2.7
 Fig. 26. _____, at 16 days of incubation. (♀) × 2.7
 Fig. 27. _____, at 17 days of incubation. (♂) × 2.7
 Fig. 28. _____, at 17 days of incubation. (♀) × 2.7
 Fig. 29. _____, at 18 days of incubation. (♀) × 2.7
 Fig. 30. _____, at 18 days of incubation. (♂) × 2.7
 Fig. 31. _____, at 21 days of incubation. (♀) × 2.7
 Fig. 32. _____, at 21 days of incubation. (♂) × 2.7

- Fig. 33. A microphotograph of a left gonad in a female chick embryo at 7 days of incubation, showing that there is no distended medullary cord in the gonad. × 160
 Fig. 34. A microphotograph of a right gonad of the same embryo as that of the fig. 33. In this case, there is, also, no distended medullary cord. × 160
 Fig. 35. A microphotograph of a left gonad in a female chick embryo at 9 days of incubation, showing the existence of distended medullary cords (D). × 160
 Fig. 36. A microphotograph of a left gonad in a male chick embryo at 9 days of incubation, showing that there is no distended medullary cord. × 160

Wolffian body in the female grows slowly but its retrogression is faster than the left one (fig. 4). Those tendencies coincide with those of the right ovary. The result of the histological examination of the preparations obtained from intact Wolffian body together with the gonad

Discussion

(1) *Asymmetry in the gonad*

As to why the anterior part of the right testis, at an early developmental stage, bends toward the outer side of Wolffian body (fig. 9), Greenwood ('24-'25) attributed it to a more rapid retrogression of the right Wolffian body than that of left one.

However, from the result of the present observation it can be said that this tendency is due to the more rapid growth of the left Wolffian body than the right one since the right Wolffian body does not show the least sign of retrogression at 7 days of incubation when the right testis begins its bending. Moreover, the growth of the right Wolffian body continues further even up to the age at 11~14 days of incubation (figs. 4, 17-23). At this stage the outward bending of the anterior end of the right testis becomes maximum. Semon (1887) claimed that the sex in chick embryos may be identified at 5~6 days of incubation. On the contrary, Firket ('14) asserted that the embryonal sex in chick can not be distinguished even at 7 days of incubation.

According to the result of the present studies, the sex of the chick embryo can be approximately discriminated at 7 days of incubation by the asymmetrical development of the female gonads (figs. 9, 10), but the sex can first be distinguished with sufficient exactness at 9 days of incubation. At that stage, the distended medullary cords and the characteristic histological structure of the ovary, first take their appearance only in the female gonad (figs. 35, 36). Minoura ('21) indicated that the development of the right ovary does not cease until the 7th day of incubation. Mimura ('28) described the frequency of the occurrence of asymmetry of the testes in 55 chick embryos ranging at from 7 to 20 days of incubation, as, $L < R = 0$, $L = R = 3$, $L > R = 52$ cases. Willier and Yuh ('28) reported the result of the measurements in the size of the gonads in 182 chick embryos at 18 days of incubation. As to the melanin pigmentation of the testes of chick embryos, Mimura ('28) found 6 cases in 53 White Leghorn embryos, and Willier and Yuh ('28) also found 5 cases out of 203 embryos in the same material. Kawano and Takahashi ('46) described about the histological study on the melanin pigmentation in the testes of chickens.

Lillie and Yuh ('32), and Trinkhaus ('48, '53) reported the relationship

between the melanin pigment and hormones in chickens. However, so far as the present writer knows, there is no publication about the bilateral asymmetry of the melanin pigmentation on the gonad throughout the whole embryonal stage in chick. The reason why the melanin pigmentation does not take its appearance on the embryonal ovary is an interesting problem.

(2) *Asymmetrical development and retrogression of the Müllerian duct*

Gasser (1874) advocated that the growth of the Müllerian duct in the male stops at 8 days of incubation and then it begins to retrogress from its anterior end toward the posterior end.

Minoura ('21) indicated that the retrogression of Müllerian duct in the male embryo does not necessarily begin from its anterior end but it may retrogresses simultaneously from several parts.

Greenwood ('24-'25) described that the Müllerian duct in the male begins its retrogression at 8 days of incubation and then disappears completely at 14 days of incubation. However, in the present material, the retrogression of the Müllerian duct in the male begins from several parts of the duct at 10 days of incubation and suddenly disappears at 11 days of incubation. (fig. 17).

(3) *Asymmetrical development and retrogression of the Wolffian body*

Though there have been published many investigations regarding the development of the Wolffian body, there is no publication on the asymmetrical development of Wolffian body and its relation to the development of gonad.

As the present writer has already pointed out at the early developmental stage, the border region between the Wolffian body and the gonad in chick embryo shows a continuity in histological structure without a boarder-line, and there can be seen a clear transitional phase from the cellular elements of the Wolffian body into those of the gonad (Chishima '52). From these facts the parallelism between the size of the right ovary and the Wolffian body may easily be understood (figs. 12~31).

(4) *Origin of the bilateral asymmetry in the Urinogenital organs in chick embryo*

Asymmetrical development of the reproductive organs in the female birds have been of interest to biologists. Though several workers have studied on the matter, there is still considerable confusion in the opinions. As has mentioned in the previous chapter, the left side predominance in the testes and Wolffian bodies is significant especially in the Müllerian ducts of the female and in ovaries it is more evident.

As to the cause of inferiority in the development of the right ovary in

bird Hoffman (1892) attributed it to the effect of the pressure imposed to the vena cava inferior, while Firket ('18) ascribed it to the pressure to the right ovary by the left ovary. Stieve ('24) pointed out that the pressure from the right lobe of liver to the right ovary is the cause of the inferiority of the latter (quoted by Witschi '34). Witschi ('34) asserted that the degeneration of the right ovaries and of right Müllerian ducts in aves is due to the result of the phylogenetic adaptation to the aerial habitation. The present writer also considers that the possibility of such physical factors presented by the investigators described above should be accounted for as a partial cause of the left side predominance of the gonad in the chick embryos it goes without saying that the tendency is due to a genetic characteristic in bird.

But it should be taken into consideration that the asymmetry in avian gonad should not be discussed only from the basis of the data obtained by the observation on the development of gonad. On the contrary, it should be considered in relation to the other urinogenital organ and the pose of the embryo in an egg.

Therefore, the present writer believes that the following factors may deserve much consideration in explaining the direct causes of left side predominance of urinogenital organs.

(i) Chick embryos lie down on the left side and flexing the body toward the right side in the developing eggs. Hence the right side of the embryo may be subjected to a more strong pressure than the left. Thus the left side of the body may be supplied with more abundant blood than the right.

(ii) Vena cava posterior ramify into two branches at the posterior end of the Wolffian body and the left branch is always larger than the right one (figs. 10, 29). In addition to this fact the heart is localized somewhat near the left side of the body. These facts also indicate the left side predominance of the blood supply in the chick embryo.

(iii) Origin of the cellular elements in the embryonic gonad. Witschi ('35) claims that the asymmetry in the avian gonad is due to a primary, hereditary deficiency of the right cortical inductor, so that he supposed the active migration of the Primordial germ cells from the right to the left gonad. Swift ('15), Huettner ('50) and many other investigators attributed the more rapid and continuous growth of the left ovary in chick embryo to the more active mitotic proliferation of the left ovary than the right one.

However, as the present writer has pointed out in the previous report

(Chishima '52), the opinions presented by Witschi, Swift and the others have neither been substantiated by a firm evidence of active migration of primordial germ cells nor by an evidence that the growth of the gonad is brought about by mitotic proliferation only. On the contrary, the mechanism of the retrogression of the right ovary can be referred to the lesser blood supply [described above in (ii) and (iii)], and deficiency in capacity of the fixation of the blood cell, especially the erythrocytes and of their differentiation into the cellular elements in the gonad. The right ovary, therefore retrogresses in accordance with retrogression of the right Wolffian body (Chishima '51, '52, '57, '58).

Summary and Conclusion

Studies were carried out on the relation between the development of the urinogenital organs and the sex differentiation in 225 ♀ chick embryos obtained by crossing female Barred Plymouth Rock with male Rhode Island Red. The age of the embryos ranged from 4 to 21 days of incubation. The results of the studies are summarized as follows:

- (1) The sex of the embryo is nearly possible to tell at the age of 7 days of incubation, since at this age there appears a bilateral asymmetry in the female gonads. However exact discrimination of that sex in embryo is first able at an age of 9 days of incubation by the appearance of the dilated medullary cord in the female gonad at that age (figs. 35, 36).
- (2) The right ovary in the female does not cease to develop at the 8 or 9 days of incubation, but continues to develop till the age of 15 or 16 days of incubation, and then it begins to degenerate, but persists as a rudimentary gonad still at the time of hatching. (figs. 1, 31).
- (3) Ratios of the size of the left gonad to the right one in the male chick embryos are indicated by "size indices" (projected area of left testis that right testis), and they showed fluctuation from 0.90 to 1.49 throughout the whole embryonic period, and a curve of values plotted against various stages shows a wave due to the rising values in both the earlier and the later stages of incubation, and the lowering values in the middle stage of incubation (fig. 2). The size indices of the embryonic ovaries fluctuate from 1.00 to 8.24. The curve of the indices rises, however, continuously from earlier embryonic stage toward the later embryonic stage throughout the whole embryonic period (fig. 2).
- (4) The anterior part of the right testis in 7 days embryo begins to be

toward the right side, while the posterior part bends toward the left. Thus the right testis is transformed into somewhat S shaped gonad. (fig.11)

5) The gonads of both male and female chick embryos which have not been subjected to any experimental treatment manifest occasionally various abnormal shapes, and such abnormalities are more frequently found in the right gonad than in the left.

6) Melanin pigmentation in the testis appears from 14 days of incubation, and the pigmentation is more frequent in occurrence and more intensive in degree in the left testis than in the right (tab. 4).

7) Mullerian ducts of both right and left sides in the male embryo and the right duct in the female do not cease to develop on the 8th day of incubation as has been believed, but they continue to grow further until 9-10 days of incubation. In the male embryo the Mullerian duct begins to undergo a retrogressive change and the whole duct becomes somewhat cloudy substance as the result of degeneration at 11 days of incubation, and then it disappears completely on the following day, thus it is not to be seen in the 12 days embryo. In the female however, the retrogression of the right Mullerian duct begins from its anterior part at 10 days of incubation and retrogresses toward posteriorly, but the width of the duct still increases in size and its posterior part remains still at the hatching time. (figs. 3, 31)

8) The growth of the female Wolffian bodies continues longer than in the male. The left Wolffian bodies in both sexes continue to grow for a longer period than the right ones, and therefore the retrogressive changes take place later than in the right one. The value of "size index" (L/R) of Wolffian body is larger in the female than in the male. No decided sex difference can be found in the Wolffian ducts (figs. 4, 5, 6-32).

9) The left side predominance of urinogenital system in the chick embryos is most probably caused by the facts: attitude of the embryonic body (lying on its left side), and flexing or bending of the embryonic body to the right side, in the early stage. And these special conditions of the embryonic body may cause a physical depression of blood supply to the right side of the body by more severe pressure acting upon that side than

of the feather primordium is to be discerned about
than in the female. There appears a very striking
of head in the male chick embryo of 12 days of
area of the bloody spot the "white spot" (white

feathering area) then makes its appearance at 14 days of incubation, while in the female embryo such a secondary sexual character fails to appear. And some of the other secondary sexual characters were also discussed.

This study was carried out chiefly during the years 1940-44 at Kyushu University and supplemented by subsequent works. Some of the related matters were reported in the author's previous papers (Chishima '51, '52). But in this paper the author described informations omitted in the previous papers and the results obtained in the subsequent works.

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III A review and consideration on the sexual photoperiodicity of domestic and wild animals.

by K. Chishima

(Research Bull. Gifu College of Agricul. No.68. August. 1950. Gifu. Japan. pp. 183-197)

Summary

As regards the sexual photoperiodicity in animals, many workers believe that the light is only or the most important factor which accelerates the sexual activities of the animals through the increasing internal secretion of pituitary body. However, it seems to the author as an inadequate conception that the light is the only and decisive factor to promote the sexual activity in animals, because the sexual activities of the animals are combined resultants of the reactions to the several kinds of factors, such as their own inner hereditary and physiological sexual-rhythms with the environmental factors, namely, temperature, light and food, etc.

In natural condition, sunlight always accompany, directly or indirectly, with temperature and food, etc. It may be an inevitable biological means by which investigators carry out the analytical studies on the reaction of animals to a certain factor abstracted from many other combined factors. However, it should be taken into account that the animals may show, at the same time, the reactions not only to the light but also to the closely related other factors such as temperature and food, etc., according to their behaviours acquired through their phylogenetically recapitulated adaptations to the environments.

The present writer, further, pointed out that the psychological effect (libido or sexual affinity) may be accelerated, most probably, by seeing or searching the opposite sex by means of additional illumination. So that it should also be taken into account for the resolution of sexual photoperiodism. In other words, no study on the sexual behaviour without regarding to psychological factor, by any means, may be referred to as a reasonable and reliable investigative method.

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- (1) On the confrontation between oriental and occidental thought, and their synthesizing.
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- (2) Criticism on the current scientific methodology.
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- (4) Confrontation on the view of life between Orient and Occident and its unifying.
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- (5) Antagonism between the mechanism and vitalism, and its unification.
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- (6) Secret of nature which hidden among the border-area (Grenzgebiet).
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- (8) Fusion of the oriental medicine and occidental medicine (Ibid 3-4, 1966)
- (9) On the wave and spiral tendency of the forms and functions in life. Report 1. Asymmetry and its meaning (Research Bull. Nagoya Commercial Univ vol. 12. 1967)
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- (10) Basic element of life (Material and Energy)(Seimei to Kiketsu 6-3, 1969)
- (11) Antagonism between materialism and idealism, and its unification (Ibid. 6-4, 1969).
- (12) Antagonism between material versus energy, or mechanism versus vitalism and their theoretical unification. (Research Bull. of Nagoya Commercial Univ. vol. 14. 1970).

(C) Monograph

All principles and practices as to the above mentioned eight fundamental and revolutionary principles advocated by this author are also described on the other nine volumes of this series. — "the Chishima's Complete Works on the Biological and Medical Sciences". (About 5,500 pages)

Especially, the full works of this author's on the wave & spiral tendency (Bio-Dialectics) of organisms (including mental life and civilization) are described in the "CHISHIMA'S COMPLETE WORKS" vol.7 (pp.1~600).



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