ACTA BIOLOGICA

ACADEMIAE SCIENTIARUM HUNGARICAE

SUPPLEMENTUM 4

(SUPPLEMENTUM AD TOMUM XII)

PROCEEDINGS OF THE FOURTH MEETING OF THE HUNGARIAN BIOLOGICAL SOCIETY

Debrecen, May 19–21, 1960

AKADÉMIAI KIADÓ, BUDAPEST
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ENERGY CHANGES IN THE LIVING ORGANISMS

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The living organisms are practically never in a completely static state. The constant changes taking place in the organisms necessitate the uptake and utilization of energy. From this point of view the living cells must be regarded as special systems with a constant energy uptake, release and turnover. The consumption of foodstuffs provides the energy and the building blocks necessary for the maintenance of a favourable ratio of anabolic and catabolic processes. Energy is the ability of a system to perform work.

For the understanding of life phenomena the knowledge of the underlying energetic processes is indispensable. The neglection of the principles of bioenergetics leads necessarily to vitalistic-idealistic explanations as "vis vitalis" etc. In order to approach this difficult field of natural sciences the biologists must know the basic concepts of thermodynamics and bioenergetics.

The question has often been raised whether or not the second law of thermodynamics is valid for the living organisms.

According to the first law of thermodynamics the heat is one of the basic forms of energy. In a closed system, the sum of all energies remains constant.

The second law deals with the possibility of transformation between the various forms of energy and also with the transformation of energy into useful work. Thus, the total and constant conversion of heat into useful work is impossible. The heat engines release the major part of the produced heat without converting it into work.

The mechanical, chemical and some other forms of energy can quantitatively be converted into heat. In the opposite direction this process is not quantitative. A fraction of the energy is needed for the molecular movement and therefore it cannot be liberated. This part of the energy is called "inner energy" of a system in contrast to its "free energy" (F) which is available for the performance of useful work. The total heat content of a system at constant pressure and temperature is called enthalpy (H) which is the sum of free and inner energy. The inner energy is proportional to the absolute temperature (T). It is usually denoted as TS, "S" being the *entropy* $\left(\frac{Q}{T}\right)$. This is the so called entropy factor; with other words *bound energy:*

$$H = F + TS$$

In order to understand this equation the quantitative relation between work and heat production (law of JOULE) must be known. If a system performs work (W) and produces or consumes heat energy (Q) the direction and amount of work and also the amount of heat produced may be different, however, the difference Q — W is always the same and its value is characteristic for the system if the initial and end values remain the same. The same is true for the chemical reactions. This is expressed by the law of HESS. The energy change of a system is: $E = Q - W$. The system may take up or may release heat (Q). The system may perform work itself or some outer force may perform work on the system. The value of energy can, therefore, be expressed by the respective values of heat and work and does not depend on the intermediate changes taking place in the system. Energy = intensity factor multiplied by the capacity factor. In the case of heat energy (Q) the temperature (T) is the intensity factor and the $\frac{Q}{T}$ value the capacity factor. The part of the heat energy of a system which is able to produce a change of 1° C

$$Q \text{ (calory)} = T \text{ (temperature)} \times \frac{Q \text{ (calory)}}{T \text{ (temperature)}}$$

As the Q — W value, the $\frac{Q}{T}$ function is also suitable for the predetermination of the behaviour and *changes* of physicochemical systems. Therefore, this function has been called *entropy* and denoted "S".

The change of free energy is equivalent with the maximal amount of work which the system is able to perform. This relationship is given by the following equation:

$$W \text{ (maximal amount of work)} = Q \frac{T_1 - T_2}{T_1} \text{ or } W = Q - \left(\frac{Q}{T_1}\right) T_2.$$

In the biology not the absolut amount of energy contained by the various systems is important but the change in energy. Thus,

$$H = F + TS$$

H = the change in heat content
F = the change in free energy (after work at constant volume and temperature).
G = the change in free enthalpy (after work at constant volume and temperature)
S = the change in entropy

The entropy can also be expressed in calories. Its changes (ΔS) are expressed as calory per mol per absolute temperature.

Entropy is the part of total energy of a system or chemical reaction which cannot be converted into useful work. The probability of the maintenance (stability) of a system is also meant by this term.

If for example the ice of 0° C will be heated and this results in the formation of water, equally of 0° C temperature, the crystalline structure of the water is destroyed. During this process all the heat is used for the increase of entropy (ΔH and ΔS are positive). As no useful energy is obtained F = 0.

The amount of energy is expressed in calories or in ergs, as all the forms of energy be converted to heat or work-units.

The calorimetry gives no clear-cut indication of the free energy changes (ΔF). The direct measurement of the changes in free energy (ΔF) is only possible in the case biochemical reactions associated with measurable electrodpotential-changes. In all other cases the equilibrium constants of the reagents and that of the end products must be determined. The difference between the ΔF value of the system at two different temperatures is a measure of the tendency of the system to reach an equilibrum. If the ΔF value is negative the reaction, in the presence of a suitable enzyme, takes place *(exergonic reaction)*. In the case of positive ΔF value the reaction can only proceed if it is coupled with an exergonic reaction *(endergonic reaction)*. If the changes in heat content are taken into account (ΔH) the corresponding "exothermic" and "endothermic reaction" expressions can be used. At one side of the thermochemical equtions the heat of the reaction and the amount of heat given off (—) or taken up (+) must be noted. In such equations the state of the various substances (solid, liquid, gazeous), the values of the temperature and pressure must be given. If not mentioned, stabil state at 25°C and 1 atm. pressure is meant. In this thermodynamic state the heat content (H) of compounds is equal to their *formation heat.*

In the case of biological processes the problem arises in how far can the energetics of growth and reproduction be reconciled with the second law of thermodynamics. The growth and development of organized living structures is associated with a decrease in entropy and an increase in free energy. This is made possible by increase in entropy and decrease in free energy taking place during the oxidation of various respiratory substrates. Therefore, the second law is valid.

The formation of carbamid from NH_3 in the living organism is at first sight also problematic from the point of view of energetics. However, this process is a fairly complicated one and the details indicate that there is no contradiction to the second law. The ornithine→ citrulline transformation is associated with the uptake of NH_3 and CO_2 and the release of H_2O. The next step, the citrulline → arginine transformation, is also connected with NH_3 uptake and the release of H_2O. The arginine formed is then split by the arginase into ornithine and carbamid.

The *photosynthesis* is associated with an increase in entropy. The total transformation of radiation into chemical energy is thermodynamically impossible. The reduction of one mole of CO_2 requires 4 light quanta ($E = 4\ h\nu$).

The *assimilation* of atmospheric *nitrogen* takes place in the root tubercules of Leguminosa at 0,2 atm. O_2 and 0,8 atm. N_2 pressure. Nitrate is formed in very low concentrations (0,0001 mol/l). This process is connected with a decrease in free energy and therefore it proceeds spontaneously.

The assimilation in the living organisms may be *photosynthetic* and *chemosynthetic*. The photosynthesis is a specific property of organisms endowed with pigment systems. The other organisms utilize for synthetic processes the energy released during the oxidation of various substances. All reductive processes are associated with energy uptake and lead to the synthesis of protoplasmic constituents *(assimilation)*. All oxidations release energy (dissimilation). The form of assimilation is different in the *autotrophic* and *heterotrophic* organisms.

The autotrophic organisms usually take up only inorganic substances. By the use of the radiation energy of the sun and by means of the energy released during the oxidative processes the inorganic substances are converted into organic ones. Such a process is the photosynthetic assimilation of CO_2 in green plants.

$$n\ CO_2 + n\ H_2O + Q = (CH_2O)_n + n\ O_2$$

This is the major route for the utilization of CO_2 in the synthesis of energy-rich organic compounds.

The higher *heterotrophic* organisms are unable to do this. They take up the organic substances from their environment.

The *prototrophic* organisms, for example the N_2-binding bacteria take an intermediate position. As to the uptake of carbohydrates they behave like heterotrophs, whereas their nitrogen requirement is fulfilled by an "autotrophic mechanism".

The living organism is able to maintain its molecules and atoms in a highly organized state only by taking up "negative entropy" from the environment (SCHRÖDINGER). The same principle is valid for the polarization of nerves (v. MURALT). A number of biologists, when speaking about entropy, mean not the physical term but something else which is called by BAAS-BECKING as "dissipation". The dissipation of non-living matter is theoretically reversible, however the dissipation of matter due to the death of the organism is irreversible.

The lecture has paid attention to the "*dynamic equilibrium*" concept of LE CHATELIER. It has been pointed out that the living organisms, the cells represent "open systems" (BERTALANFFY, PRIGOGINE). The second law of thermodynamics is valid for the open systems if they are studied in connection with their environment. Emphasis was laid on the high-energy phosphate bounds which are probably the single energy sources directly available for the cells. It seems that often SH-compounds serve as carriers between the oxidation-reduction systems and energy turnover (ATP $\rightleftarrows$ ADP $\rightleftarrows$ AMP). The problems of *coupled reactions* and those of *aerobiosis* and *anaerobiosis* were also considered. The sequence of anaerobic and aerobic reactions during cellular respiration makes the stepwise release of energy possible and thus the H_2 of respiratory substrates is not oxidized at once. The order of magnitude of energy release in biochemistry is about 10 Kcal/mol. The problem of energy content of food and that of the activation energy was also discussed.

Finally some modell experiments were presented from my laboratory on the effect of some biocatalysators on the heat production (ΔH) during the fermentation of glucose in yeast cells. These results cannot be dealt with in detail. Reactions associated with "negative reaction heat" were also observed. Some time ago the opinion was widespread that only reactions coupled with the release of heat can proceed spontaneously. This view cannot be maintained as indicated by the example of cooling mixtures. Thus, the mixing of ice with sodium chloride crystals results in the solution of NaCl (endothermic reaction) and the system is cooled down to $-18{,}4°$ C.

In contrast to the classical thermodynamics several examples are now known for the unexpected increase in free energy. These discoveries are due to studies on energetical problems by statistical methods. The large number of molecules in a system makes it understandable that in these systems the statistical rules are valid. The molecular systems exhibit quantum properties. The energy of molecules (atoms) does not change continuously but in quanta. The classical thermodynamics is fully valid only in the gravitational space but not in the biochemistry.

The high number of energy levels in a group of molecules or around the nucleus of an atom makes the distribution of *molecules*, atoms and radicals at different energy levels possible.

Thus, of the isomers of a compound the structure corresponding to the given energy levels is the most probable. It is also true that all systems tend to reach a possibly minimal energy level. The formation or not formation of a given molecular structure depends on the joint action of energetic and statistical factors. This relative probability gives the molecular basis of entropy changes. The energy levels, or with other words the height of the electron path, is determined by the movement of atoms and molecules. The higher is the freedom of movement the closer are the energy levels to each other. The freedom of H_2O molecules in water is much higher than in the ice (KLOTZ). In the case of the water-ice system the direction of change in entropy is directly visible from the properties of substance.

The copper-protein complexes are formed spontaneously (:Pr. + $Cu^{++} \rightleftarrows$ Pr. — Cu^{++}:) although the endogenous energy of the Pr. — Cu^{++} complex is higher by 3 Kcal/mol than that of the protein and Cu^{++} separately.

The explanation of this phenomenon may be that these substances are dissolved in water, firmly bound to water molecules. The formation of the Pr. — Cu^{++} complex is associated with the release of the "frozen water", as the H_2O of body fluids is called, because of its molecular structure which is similar to that of the ice. Consequently, the freedom of the movement of the molecules becomes greater and this results in an increase of entropy (KLOTZ).

The denaturation of proteins is also connected with a considerable increase of endogenous energy. The proteins in vivo are highly oriented systems. The denaturation leads to the desorganization of this structure. Therefore, the freedom of movement of the molecules becomes greater. This may explain the observation of KUNITZ that the denaturation of proteins is associated with an increase in endogenous energy and the entropy of the system increases. According to KLOTZ the increase in entropy is due to the change in bound water.

All these examples indicate that the laws of physics are valid for the living organisms as well, however, the structure of these latter greatly modifies the effect of physical forces. This explains the unique properties of the living systems.

THE PERMEABILITY OF CELL MEMBRANES

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The study of permeability is one of the most important chapters in general physiology and therefore it is not easy to give a short account of it. The aim of the present survey is to direct attention to the most important achievements and to summarize my own ideas. As final conclusion can not be drawn for the present, some earlier concepts must not be neglected and the development of our ideas concerning the problem of permeability must also be treated.

Of all the membranes occurring in the organisms those of the cell surface are the most important ones. However, data are also accumulating as to the properties of the mebranes surrounding various cell organells. The elucidation of the function of cell membranes is difficult because of their complex role. In addition to their mechanical function they serve as regulators of the uptake of nutrients and release of metabolic endproducts.

The study of permeability was started earlier than the existence of cell membranes was generally accepted. In our country the late professor TELLYESNICKY has not accepted the idea for a long time. On the other hand, the various results obtained during the study of permeability cleraly indicated the existence of a membrane of the cell surface. Earlier the terms "diffusion" and "osmosis" were used in connection with the uptake and release of substances by the cell. Later on, after the concept of osmotic pressure was evolved, the use of the terms "permeation" and "permeability" became widespread. The existence of the membrane of muscle fibre was early recognized but the double structure of the sarcolemma was also known. The observation of isolated muscle fibres in n/10 NaOH under the microscope clearly indicates that their whole content becomes dissolved in a few seconds and only the outer sarcolemma-layer remains intact. The advent of electron microscopy made a more thorough study possible. It was established that the "stroma" remaining after haemolysis of red blood cells is actually a membrane covering the content. Therefore, the "sponge-theory" of BRINKMAN and SZENT-GYÖRGYI had to be rejected. To-day data are accumulating to show the structure of cell membranes, first of all the existence of layers they are composed of. Recently GUBA succeeded in demonstrating the pores of the cell membranes.

These results, as well as the studies devoted to the chemical composition of the stroma indicated a "sandwich"-like or even multiple sandwich-like structure of the membranes which are composed of alternating lipoid and protein layers. The existence of the cell membranes could be questioned even in the past only because no attention was paid to the behaviour of the protoplasm of the damaged cell which comes in contact with tissue fluids or Ringer solution. In collaboration with G. GELEI I have drawn the attention, as early as 1944—1950, to the effect of the Ca^{++} ion content of tissue fluids or saline which results in an irreversible damage to the protoplasmic structure. In the absence of a semipermeable cell membrane this would happen always to any cell.

A number of data are available as to the thickness of cell membranes (3—100 μ). From or through the cell membranes lipoids can be secreted into the surrounding medium under physiological conditions (HANSTEEN—CRANNER etc.).

The earliest theory of selective permeability is known as the "sieve theory" based on the concept that the *diameter of the pores* of the membrane regulates the entry of molecules of various sizes. A general validity for this theory was only claimed by RUHLAND in connection with his studies on *Beggiatoa mirabilis*, a sulfur bacterium. The bacterium deserves the name "mirabilis" probably just for this reason. However, this theory cannot explain the uptake of colloidal or even microscopic particles (phagocytosis).

By the end of the last century, the *lipoid-theory* of OVERTON opened new horizons in this field. According to OVERTON the cell membrane behaves as a complex body composed mainly of lipoids, i. e. phosphatids and cholesterol. The definition "lipoid" refers to the solubility properties of the various substances. However, this definition is too rigid and simplified. Thus, the lecithine is dissolved in water to a high extent but not in aceton and under dry conditions not even in ether. Similarly the solubility in ether of tripalmitine or tristearine is low. The cerebrosids are not easily dissolved in hydrocarbons, cephalines in alcohol, etc. The parallelism between permeability and lipoid solubility is restricted to a small group of substances. Therefore, no clear-cut correlation could be detected between the good lipoid or poor water solubility of the various substances and their ability to enter the cells. On the contrary, the permeability of water and that of a number of water-soluble substances is excellent.

Since the proposal of OVERTON several authors endeavoured to support his theory. However, no clear-cut results were obtained, particularly as no attention was paid to the nature of the lipoids contained by the cell membranes and to the study of solubility of various substances in these lipoids. The prestiqe of NERNST greatly contributed to the acceptance of the lipoid-theory. It gained in importance through the theory of MEYER who emphasized the lipoid solubility of the narcotica.

OVERTON divided the various substances into groups according to their ability for penetration (good, medium, poor). These groups are empiric in nature and contain the exceptions to the rule of lipoid theory. The greatest difficulty is the explanation of the high penetration rate of water. Therefore, a number of authors endeavoured to supplement the lipoid theory. By that time little attention was paid to phagocytosis as the physicochemical explanation of such a complex phenomenon seemed hopeless. However, even among the vital dyes there are some colloidal substances. The difficulties are partly overcome by the observations made on the alcalic or acidic oil mixtures of NIERENSTEIN. First of all the behaviour of the water-soluble vital dyes could be understood on the basis of these modell experiments. NATHANSON pointed out very early that the lecithine dissolved in water exhibits hardly any lipophilic properties. The *mosaic* concept of the cell membrane also dates back to NATHANSON. According to this idea the lipoid parts of the cell membranes are separated from each other by hydrophilic canals. In the opinion of COLLANDER only molecules not larger than 4 Å can cross the hydrophilic canals. This is the size of a carbamid molecule. Somewhat higher values were reported only for some plant cells (HÖFLER). The more recent theories are all complex and based essentially on a reconciliation of the sieve and lipoid theories.

It is interesting to note that in the early twenties the adsorption theory of TRAUBE was strongly supported. According to this idea the process of adsorption is a prerequisite of permeation. This is probable due to the exact experiments of WARBURG carried out by this time. Only after the elucidation of the physical nature and mechanism of adsorption became clear that the adsorption theory of permeation can not be maintained any longer.

The scientists trying to find a suitable explanation for permeability have paid no attention to the BRINKMAN—SZENT-GYÖRGYI phenomenon according to which the surface-active substances spread with an astonishing speed on the surface of water (approximately 1 m/sec). According to my experience this phenomenon is shown not only by the "obligate" but also by the "facultative" surface-active substances of the organisms (fatty acids, etc.). Therefore, the permeation of such molecules via the hydrophilic pores of the membranes does not seem impossible.

I have published a variant of the lipoid theory in 1932. According to this theory the poor permeability of the substances is explained by their coagulating effect on the membrane. In this way an occlusion of the pores occurs which is elicited by the substances in question. This effect is missing or even a solubilizing effect is exerted in the case of substances of good permeability. This theory is supported by the total parallelism between the permeability of a substance and its effect on lecithine sols. The opacity of a lecithine sol prepared by simple rubbing in water is greatly increased upon treatment with substances of poor permeability. Molecules of medium permeability increase the opacity of the sol only to a small extent, whereas the substances of good permeability, in accordance to the rules of OVERTON, hardly affect the opacity or even decrease it. It may be concluded that on the cell surface similar processes may take place and the degree of dispersity of phosphatides plays a major role in permeability. The dispersity may be affected by the various substances in vivo as well. This theory, which may be regarded as one of the "colloid theories", was described only at a few occasions and therefore received relativelv little attention. The theory is further developed by professor BALOGH, my former student. It must be emphasized that the lecithine is easily decomposed or oxidized and this leads to the formation of desoxylecithine. Most preparations contain smaller or greater amounts of this substance. (The preparation of highest purity was aLecithin extra rein", Schering—Kahlbaum). The sensitivity of preparations containing higher "mounts of desoxylecithine is reduced and the effect of some substances in this case may prove different.

HÖBER called the attention to the interesting fact that the alien, particularly the toxic substances penetrate the cells very easily whereas a number of compounds of vital importance (sugars, amino acids) belong to the group of substances of low permeability. Therefore, he concluded that the penetration of these substances must depend on special energy yielding mechanisms. Also, the ability of the cell to accumulate substances against a concentration gradient had to be explained. It seemed that the law of FICK is not valid for the living cells. For example in marine organisms, first of all in some algae the accumulation of iodine and in the Radiolaria *the accumulation* of the strontium is a remarkable phenomenon. Therefore, HÖBER made distinction between physical penetration (our main topic up to the present) and "*active transport*" which is an extremely complicated metabolic process. Although the term "transport" is used by the physicists in a somewhat different sense, it seemed reasonable to adhere to this expression as a synonym of "*transfer*" which is also very widespread. In the English and American literature these terms are not used in a consistent way. It seems better to keep "permeation" as a more general term which refers to the penetration of substances into living cells without taking into account the mechanisms involved.

The simple physical penetration may also be more complicated than described above. The transport is always complicated and according to the prevailing opinion special ferment systems (according to MONODE permeases) play a part. In the original form of this theory the role of the enzyme is to unite the permeating substance with a "carrier" and the *permeability* of this complex is increased. A number of authors suppose that the lipoid solubility is also increased and the improved permeability is actually due to this fact. This is in line with the old lipoid theory. In the inside of the cell an other ferment splits the complex into its components and releases the original substance. A wide variety of similar hypotheses were put forward, however ,none of them could overcome the original difficulties. Thus, alien and toxic substances, may also be taken up by active transport (d-glutamic acid, methyl esters of various sugars etc.). Therefore, the number of specific ferments required to catalvze the transfer process is too high. It is also strange that always substances of higher molecular weight exhibit a higher permeability. Attempts to isolate and identify the carriers, except in a few cases, proved unsuccessful. Some authors visualize the action of the carriers as a contraction or rotation of proteins (MITCHEL). However, these ideas lack the sound experimental basis.

In my opinion the most plausible explanation is ignored by the scientists. The fashionable attribute "molecular" is in most titles only a program which is never fulfilled. The physicochemists are unable to give a picture, in a form useful for physiologists, of the splitting of high-energy bonds. Sometime even the need for such an approach is not recognized.

The approach to the nature of transport processes is the easiest by the use of enzyme poisons. These substances inhibit the active transport. Some transport processes are inhibited mainly by the inhibitors of glycolysis, some others by the absence of oxygen and most of them by the low temperature. It is also important to stress that the substances of the cell membrane have a definite steric *organization* within the membrane. Thus, if ATP molecules strictly oriented on the surface are split, it is well possible that one of the directions of the movements of the released phosphorus groups is statistically favoured and consequently molecules bound in a regular pattern on the surface or to the wall of the pores can be pushed inward or outward depending on their position (corpuscle-impulse theory). In view of the intense heat movement

of atoms it is clear that a somewhat more or somewhat less impulse may result in great changes of molecular permeation. Therefore, there is no need for the carriers! These ideas were repeatedly put forward by the author in the period between 1951-1958.

This hypothesis can only be proven by detailed studies. First of all the structure of the cell membrane must be better understood. More information is necessary concerning the localization of high-energy bound containing compounds ("pergens") in order to understand the nature of transfer processes. However, a further development is necessary in the field of the chemical corpuscular mechanics as well. The complexity and diversity of the process of permeation can only be understood if a considerable progress in these fields has already been achieved.

Some connections between the uptake of cations and anions are now fairly well elucidated. Such a relationship exists between the K^+ and Na^+ ions (CONWAY) or between the K^+ ion and glucose under the influence of insulin (VERZÁR). These are the cases of the coupled permeation, in contrast to the "*solitary*" permeation of single ions or compounds. The latter case may result in transient hypertony with the corresponding movement of water.

The *specificity of organs* is also highly interesting. For example γ-aminobutyric acid, the important inhibitor compound of the brain, is only transported in brain slices under aerobic conditions in the presence of glucose (TSAKATA, NAGATA, HIRAMO). Similar observations were made with glutamic acid and potassium ion. The *d* and *l* forms of glutamic acid exhibit similar behaviour. This is also true for other substances having *d* and *l* forms. Apparently the steric structure has little importance from this point of view (TERRIER).

The explanation of membrane potentials was looked for since OSTWALD in the field of permeability phenomena. Due to the results obtained with new methods the opinions underwent considerable changes. The phase-theory of LOEB-BEUTNER was predominant for a long time, however, the more modern ideas return to the OSTWALD—BERNSTEIN membrane-theory. All these results are of a great importance from the point of view of nerve physiology. As to the role of single ions new ideas are developed. Although the experiments of HODGKIN and HOROWITZ support the earlier concepts even in the case of a single fibre, STÄMPFLI reached the conclusion that the resting potential is not only due to the difference of inner and outer concentration of potassium ions. According to STEPHENSON the sodium and potassium ions are always exchangeable and both of them play a part in the establishment of potential differences. SCHERNER holds the view that because of the sudden appearance of the action potential the earlier explanations are not satisfactory. Partly the hyperpolarization, which appears after activity, requires a more detailed explanation (RITCHIE and STRAUS) and the retention of the action potential, mainly under anaerobic conditions, is also a phenomenon which is not fully understood at present. In my opinion not only the different speed of diffusion of the various ions may result in potential differences but also their different transport. This possibility was not given sufficient thought up to the present. The solution, in this field too, is only made possible by a better understanding of membrane structure and permeability.

The main conclusion which can be drawn from the above survey is that the structural characteristics of the cell are to be looked for even in the atomic dimensions and consequently all processes are more complicated than were believed at the beginning of this century.

Abstracts of papers read at the sessions of the Section A

INVESTIGATIONS ON THE COEXISTENCE THEORY OF PLANT COMMUNITIES

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If we accept the definition that plant community means synoecological convergence, a coexistent assembly in which each population occurs for some special reason of its own, the interconnection of cenological phenomena will become much easier of interpretation. The author has attempted to determine these special reasons by ascertaining correlations and making variance and discriminatory analyses in respect of dominant populations in series of soil samples taken from 50 stand, each, of three plant associations (*Brometum tectorum*, *Alopecoretum pratensis*, *Agrostidetum tenuis*). The higher the number of populations in a community controlled by a significantly identical factor, the less coexistent and the more "organized" the association will prove to be. We shall thus obtain the series of gradation well known from the practice of classification (sand grass, swamp meadow, hayfield community). Similarly, a statistical evaluation of the stands gives analogous results: we obtain the same sequence as to the spatial discontinuity of the stands, the discreteness of the noda, the concrete character of the association, the homogenity of composition and the capacity of regeneration. Thus of the associations examined it is *Agrostidetum tenuis* which represents the most coexistent, most loosely organized association consisting of the most variable and most continuous stand and which is, at the same time, least homogeneous, most abstract and practically the most difficult to classify. These controversial notions (*e. g.* abstract-concrete) should, therefore, not be regarded as mutually exclusive opposites but rather as statistical borderline cases. Although of an insufficient number from the statistical point of view, the examined samples justify the conclusion that the term "association" cannot be applied to *Agrostidetum tenuis*. Another important result of the theory of coexistence is the conclusion that all non-experimental (empirical) investigations regarding the separation of associations should exclusively based on a statistical ("one-dimensional") evaluation of floristic data. All other factors (soil, climate) are determinative inasmuch only as they affect floristic composition (*e. g.* ecological homogenity = floristic-cenological homogeneity).

VEGETATION-MAPPING AND STATION-EXPLORING IN THE SOPRON-HILLS

S. CSAPODY

STATE FOREST-MANAGEMENT OF SOPRON

The Sopron-Hills consist chiefly of a base rock of gneiss and mica. The forest-soils in them are acid brown forest-soils. The annual rainfall is about 700 mm. In the natural and artificial forest-associations there has, since 1959, a systematical vegetation-mapping and forest station-exploring been in progress. The object of this work is a thorough analysis of every station-factor, the determination of existing interactions and the drawing of practical conclusions.

A contour map of 1 : 5000 is used for the works in question. Of the planned 5700 hectares a vegetation- and a growth-map of about 600 hectares have so far been finished. A mere comparison of these with VENDEL's geological-map explains a number of phenomena. For detailed investigations, test plots of 20 × 20 m are chosen per 4 hectares. Their present number amounts to 120. Phytocoenological, pedological (both in field and in the laboratory), and structural (species, height, thickness, age, length of crown, stock-classification, increment,

mass, etc.) investigations are in progress on all test plots. Stereo-photographs are being taken of all areas.

The most frequent forest-associations on extremely acid soils are those of the types of *Luzula-Quercetus* KNAPP 42. *(luzuletosum, vacciniosum, callunetosum, deschampsietosum,* etc.) and, as a degraded stage, the types of *Betulo-Callunetum* ZÓLY. 40 (= *Calluno-Genistetum germanicae).* On more favourable soils we find the types of *Luzulo-Querco-Carpinetum* (TX. 37.) SOÓ 57. Microclimatically there appear *Luzulo-Fagetum* (MARKGRAF/HARTM. 48.) *vacciniosum, luzuletosum, subnudum, dicranosum,* etc.). The types of *Querco petraeae-Carpinetum* SOÓ et PÓCS 57 *(melicosum, asperuletosum, caricetosum p.,* etc.) are characterized by their mesophytic nature and their greater yield. A number of pine associations are found to occupy the place of different types of broadleaved forests which makes it possible to evaluate the present results of the efforts to convert leaf forests into pine forests. This is a pioneering work and many theoretical and practical results may be expected of it.

DATA ON WEED VEGETATION IN DIFFERENT GRAIN-CROPS

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Weed-investigations were carried out at Gödöllő (situated east of Budapest, at a distance of 30 km) in the experimental rye, oat and barley cultures of the Educational Farm of the University of Agriculture, in the years 1954—55—56. The soil is sandy, its pH value varying from 7.2 to 8.3. Coenological surveys were carried out in squares measuring 4 × 4 m, by means of the BRAUN—BLANQUET scale, as a rule three times during the period of vegetation, namely at the onset of elongation, before the harvest and in the stubble state.

Data collected during 3 years show the presence of a total of 77 weed-species in the above mentioned crops. As regards single cultures, the greatest number of species was found in the barley (68), the lowest in the oat (13), while the rye contained 51 species. Weed-covering proved likewise to be the richest in the barley, poorest in the rye. Besides quantitative differences, also divergences of a qualitative character were encountered.

A total of 42 different weeds was found in the stubble, 36 of which corresponding to those of the crops. In contrast to the standing corn, the largest mass of weeds showed in the rye-stubble.

Regarding combination of biotypes, it was found that 12% of the weeds were of the hemikriptophyte, 8.5% of the geophyte, 78% of the therophyte and 1.2% of the hemitherophyte species.

As to flora-elements, the Eurasian prevails, the Cosmopolitan comes next, while the Mediterranean ranks third.

Of the weed-species, *Convolvulus arvensis, Raphanus raphanistrum, Chenopodium album, Polygonum aviculare, Polygonum convolvulus,* while in the stubble the species already mentioned, as well as *Digitaria sanguinalis* and *Setaria viridis* are to be mentioned.

TAXONOMICAL EVALUATION OF LINEAR LEAVES IN THE FAMILY GRAMINEAE

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The basic structure of Gramineae is fairly uniform. This applies to the genera of temperate zones in particular. Plants of the mesophyte type have broader flattened leaves, while xerophytes are characterized by linear leaves. These two types recur in each particular genus.

The autor had occasion to observe the interrelation between the affinity of species on the one side and xeromorphy on the other side, during his study of the genus *Sesleria.* Part of these species have broad, another part linear leaves. Their last taxonomist, DEYL, classified the latter under the head of turma *rigida* DEYL. Investigations on living material, made by

the author, led to the result that turma has no uniform origin: its species originate from two sections, so that one has to deal with a phenomenon of convergence in this case. The $2n = 28$, tetraploid *S. juncifolia* SUFFREN *(S. tenuifolia* SCHRAD.) of the Illyric area, for example, used to be regarded as belonging to the same species as the $2n = 56$, octoploid *S. apennina* UJH. of the Apennines. Both have linear-leaves, with tourtously filamentous leaf-sheats and elongated panicles. This latter species is, at the same time, the octoploid of the $2n = 28$, tetraploid linear-leaved *S. insularis* SOMM. of the Tyrrhenian massive, while the octoploid of *S. juncifolia* SUPPR. is the Croatian *S. kalnikensis* JÁV. with broad-leaves. There exists likewise no closer connection between *S. rigida* HEUFF. *S. serbica* (ADAM.) UJH., *S. filifolia* HOPPE and the *S. taygetea* HAY., the *S. kraynae* DEYL., the *S. albanica* UJH. which three latter belong to the other section.

It is demonstrated by the author that the leaves of all linear-leaved *Sesleriae* are secondary, so-called juvenile leaves, the epidermal structure of which is no longer characteristic. Occurring in both types this phenomenon is not connected with polyploidy: it is the modifying effect of the habitat which constitutes the principal factor.

A NEW CENOLOGICAL CLASSIFICATION OF XEROTHERMIC FORESTS (QUERCETEA PUBESCENTIPETRAEAE) IN EUROPE

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Abstract not received.

CONTRIBUTIONS TO THE VEGETATION OF THE DELTA OF THE DANUBE

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The results of an excursion in the area of the Danube-Delta in 1959 are reported. The major part of the area (87%) consists of a vast lake whereas a minor part is formed by prominent sand-ridges. The base is mostly alluvial clay. The prominent ridges consist for the most part of sea sand. The mean annual precipitation is 300—400 mm; the area is delimited by the 11° C isotherm. The Delta of the Danube is located in the zone of steppe vegetation, the effect of which, however, owing to the water cover or the high level of ground water only comes into display on the prominent ridges with the appearance of xeromorphous swards: *Caricetum colchicae!*, *Festucetum arenicolae!* In the dune-interstices *Lythro-Holoschoenetum* indicating the proximity of ground water stands out sharply, An important area is covered by pastures mottled with sodic patches, in the environs of Letea with *Cynodon dactylon*, *Agrostis alba* or *Puccinellia limosa* swards. In the deeper parts, of the dune-interstices — in connection with the high ground water level — azonal groves: with *Querceto-Ulmetum leteense!-Fraxinus angustifolia ssp. pannonica.* The forest reaches as far up as to the steep wind-sheltered side of the dunes to establish the *Quercetum roboris-pedunculiflorae* association characteristic of the forest-steppe zone. Of the Delta, however, the extensive reedy parts and rich water vegetation of the water surfaces covering 5/6 of the area are characteristic: *Nymphaeetum alboluteae*, *Hydrochariti-Stratiotetum*, *Trapo-Nymphoidetum*, *Scirpo-Phragmitetum austro-orientale.* These stands only slightly differ from the corresponding associations of the basin of the Carpathians. Along the rivers and on the islands *Salicetum triandrae* and *Salicetum-albae fragilis* are thriving. Along with these associations the willow grove of the environs of Braila and the forest grove *Alneto-Fraxinetum angustifoliae muntenicum* of the river Arges near Gradiste were analys ed. (Exclamation marks indicate associations described for the first time.)

CONNECTION BETWEEN THE CONDITIONS OF CALCIFEROUS-SODASALIFEROUS SOILS AND THEIR PLANT VEGETATION IN SOUTH KISKUNSÁG (GREAT HUNGARIAN PLAIN)

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Most of the flat areas in South Kiskunság are growing sodic in consequence of subsoil water fluctuation. The characteristic soil-conditions lead to the development of a special plant-vegetation. Its appearance and succession depends, above all, on the water content, as also on the chemical and physical structure of the soil.

I. Zones of *Bolboschoenetum maritimi in periodical sodic ponds :* (a) *B. m. phragmitetosum* in ponds which continue to exist till late in summer, where the soda content of the higher soil-layers may reach 0.10 to 0.20%. (b) *B. m. agrostidetosum* in zones becoming dry early in summer, where less soda content appears together with higher organic matter content, (c) *B. m. puccinellietosum* with soil water content similar to the former, but only in case of increased sodification; the soda in the higher layers is above 0.20%. (d) *B. m. crypsidetosum* in rapidly desiccating sodic waterbottoms usually with lower soda and higher organic content.

II. *On flats durably covered with inland water*, the appearance of associations of *Salicornietalia, Puccinellietalia* federations of their smaller units:

(a) *Suaedetum maritimae* hung. on sodic soils with low humus content and loose sand, inundated till middle summer, where the surface soda content is 0.40 to 0.50 %. (b) *Crypsidetum aculeatae* on soil with similar water content but more favourable general soil-conditions. (c) *Acorelletum pannonici*, between the two latter.

III. *On flats covered for a short time with inland-water*, further *Puccinellietalia* associations and their smaller units.

(A) *Lepido-Puccinellietum limosae* (grass-land) (a) *L.-P. asteretosum* develops on sodifying soils of *Agrostetum albae hung. asteretosum* by excessive drainage; a still strongly humid *L.-P. l.* grassland type. Soda content of the upper layers is 0.15 to 0.25%. (b) *L. P. ast. taraxacosum bessarabici* develops from the less humid soil of *Agrosti-Caricetum distantis*, (c) *L. P tipicum* with increasing soda (on the surface 0.20 to 0.35 %) and decreasing humus content

(B) *Lepido-Camphorosmetum*, associations of soils with the highest soda content. (a) *L.-C. puccinelliosum* transition to the latter. (b) *Lep. Camphorosmetum tipicum*, 40% soda content in the upper layers.

ON BOTANICAL EDUCATION IN THE FIRST HALF OF THE NINETEENTH CENTURY

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DEBRECEN

It is often by mere chance that investigators happen upon valuable old books, manuscripts, or paintings. The author had the good luck to find, among old family documents, a small postcard-sized picture and then a 1815 edition of J. Schuster's "Terminologia botanica" the empty pages of which were covered with skillful drawings and pharmacological notes. The latter served the purpose of preparing for university examinations, and also the picture illustrates an examination at the University of Vienna: three professors are seated at a square table, among them Joseph Franz Jacouin, while only the back of the candidate is visible. There is the following inscription under the painting: "Erinnere dich bei Entlebung dieser Scene aus den Tagen der Gefecht deines Freundes", and it bears the signature "Wilhelm Fuchs 1824 Jun 5". The author obtained some biographical data from Szinnyey's work "Magyar írók élete és munkái" ("Life and works of Hungarian writers"). He also found Haberle's bibliographical work from 1838 in the library of the Department of Plant Systematics (Budapest University); it contained the following words regarding Hungarian botanists working in Austria: "D. D. Fuchs Wilhelmus Scepusiensis et Kralovanszky Ladislaus Eperiessis Sárosiensis Hungari literati et Pharmaciae editores Herbarii montis nivei in Austria ad fines Styriae (vulgo Schneeberg)". Fuchs, later manager of the mines at Selmec (Schemnitz), worked at the side of Lajos Kossuth in 1848. Kossuth was Finance Minister at that time and Fuchs the head of the Department of State Mines. He emigrated to Serbia in autumn,

1849. The works of E. Gombocz, E. Högyes, J. Proszt, the communications of J. Faller, director of the Museum of Mining, together with the present author's above data, make it evident that botanical training at the Budapest and Vienna universities was very thorough, that it extended to all branches of the discipline and that it stood at the highest level of contemporary science.

RESTORATION OF THE RESPIRATION OF A RESPIRATORY DEFICIENT ERGOT MUTANT BY P-DIMETHYLAMINOAZOBENZENE-2'-CARBOXYLIC ACID

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Our experimental material consisted of a monoascospore ergot strain (No. 1023), isolated in our laboratory, which produces small, so called "petite"-type colonies in saprophytic culture; its dry-matter production is very low. Its respiratory deficient character, as opposed to the "wild" type used as control, is indicated by the following characteristics:

It grows towards the bottom of the cultures; its O_2-consumption is very small; it is sensitive to lactic acid, but resumes, in the presence of ATP and DPN its normal growth rate. (Adenylic acid, adenosine and adenine are inactive.)

Some 120 compounds — belonging to various biochemical groups — were tested to identify the missing active principle. We found that by adding p-dimethylaminoazobenzene-2'-carboxylic acid (DAB-2'-COOH, methyl red) to the nutrient agar the growth of the mutant strain became normal. The QO_2-value and acid-labile phosphorus content increased and reached the level of the "wild" strain. The optimal concentration of methyl red is about $2 \cdot 10^{-4}$ Mol.

The action-mechanism of methyl red in the above processes is still unelucidated. Available data suggest that methyl red might get involved in the terminal respiratory system of the respiratory-deficient mutant by playing the role of the "missing link", and raising thereby the ATP-level. The question is probably related to the carcinogenic effect of DAB-derivatives.

ANTIAUXINIC EFFECTS IN THE OVERALL ACTIVITY OF AUXIN PRECURSORS OF THE SUBSTITUTED AMIDE TYPE

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The seedling morphology test, elaborated by the authors for testing the selective auxin activity of synthetic compounds, was applied to a study of the plant growth regulating activity of a number of N-monoalkylamide derivatives of 2,4-D, 2,4-DP, 2,4,5-T, and 2,4,5-TP. The observed growth-regulating effects of the studied auxin precursors were unattributable, in a considerable number of cases, to the sole activity of the enzymatically formed parent carboxylic acid. The assumption was made, therefore, that growth effects are exerted in the latter cases also by the precursors themselves, in addition to the effects of the parent auxin formed by their enzymatic degradation. The possibility of an additional activity of the precursor molecules themselves was investigated by combining 1 and 10 p. p. m. aqueous concentrations of the respective carboxylic acid with doses roughly equivalent to 0,1, 1, 10, 100, and 1000 p. p. m. of the precursors. In some of the species: compound combinations remarkable antagonism was shown by the precursor to the effects of the externally added parent carboxylic acid. The overall morphological effects of the latter treatments were almost identical with those of combinations of one of the classical antiauxins (TIBA, 3,5-dichlorophenoxyacetic acid, etc.) with the same auxins. The results obtained were illustrated by the effects of N-butyl-(2,4-dichlorophenoxy)-acetamide: 2,4-D combinations on cucumber seedlings in experiments where seedling weight, shoot-, and root-lengths were measured. The inhibiting effects of 2,4-D were relieved in these experiments by the butylamide; up to 250% stimulations were found as compared to the butylamide-free treatments. It is suggested that the discovered double role of potential auxin precursors in auxin-regulated growth processes (antiauxinic activity of the original molecule which, however, yields auxin by enzymatic degradation) might help to explain some phenomena in the auxin regulation of natural growth processes.

ACTION OF ETHANOL ON GROWTH AND DEHYDROGENASE ACTIVITY OF CANDIDA ALBICANS

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Tests of antibiotics and chemotherapeutics for fungicidal or fungistatic action are to be often performed in ethanolic solutions. No data are available in the literature about the action of ethanol on *Candida albicans.*

The action of ethanol on growth was measured by the turbidity of cultures in Sabouraud-glucose-bouillon containing various amounts of ethanol. The turbidity was plotted against time in a half-logarithmic system with the use of following equations: *i. cell count per ml = extinction X* 3.10^8 (we found parallelity between cell count and extinction) ii. *log. extinction* at *t* time = *log. extinction at start + growth constant X time* (this is the known logarithmic growth equation of microorganisms substituting extinction for cell count according to the first equation). From growth curves, the growth constants belonging to various ethanol concentrations were determined. The growth quotient (growth constant with ethanol per growth constant without ethanol) served as the *relative biological efficacy* of the ethanol concentration in question.

Plotting growth quotients as function of ethanol concentration on the first day, a nearly linear regression was obtained which subsequently changed so that on the fifth day it became a one-grade regression which showed no action between 0.002 vol. % and 4—5 vol. % of ethanol concentration, and was then running quickly near to complete inhibition of growth at 10 vol. %.

On the other hand, endogenous dehydrogenase activity (EDA), measured with triphenyltetrazoliumchloride (TTC), gave the inverse of the fifth-day concentration-activity curve, i. e. there was no effect from 0.002 vol. % to 2 vol. % of ethanol concentration with increasing activity from that point. At 10 vol. % of ethanol concentration, 250% activity of the control was measured.

These two parallel experiments show that the action of some compounds on growth and on enzymatic activity, respectively, may be inverse and need not be parallel.

Higher values of EDA obtained with higher ethanol concentrations suggest that permeability of TTC increases with higher ethanol concentrations.

EXAMINATION OF ANTIMICROBIAL SUBSTANCES IN THE LEAVES OF TREES AND BUSHES

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With a view to elucidating the occurrence of antibacterial and antifungal compounds, the leaves of 244 tree and bush species have been subjected to detailed examination. The intensity of antimicrobial effect was checked at pH 6.5 and pH 7.5 with the horizontal agar-diffusion method after having reduced the leaves into pulp. Two strains of Gram positive bacteria, two Gram negative ones and three fungi were employed for the tests. The leaves were examined in three developmental stages: in spring immediately after sprouting, in summer following full development, and in autumn after defoliation.

Antimicrobial compounds could be demonstrated in numerous cases. These compounds are selective, and inhibit the growth of Gram positive bacteria in the first place. Spring leaves for instance, proved to be efficacious at pH 6.5 against *Bacillus cereus* var. *mycoides* in 37.9%, against *Shigella shiga* in 4.9%, and against *Candida albicans* also in 4.9% of the cases.

Considerably different is the efficacy of leaves of different age. The pulp of young leaves inhibited the growth of *Bacillus cereus* var. *mycoides* in 37.9%, that of mature leaves in 23.3%, and that of shed leaves only in 15.3% of the cases.

CELL METABOLISM IN THE ROOT OF VARIOUS CEREALS

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It was in the course of investigations into the metabolism of vegetable organs that the author compared the recently produced wheat-rye hybrid *Triticale* with the two parent plants in respect of cellular metabolism in the roots of the seedlings and in respect of the intracellular changes in nucleic acid phosphorus (NA—P). Analyses were performed in 2 mm zones of the root, and results then referred to single cells. Determination of nucleic acid was based on P-content. Analysis of the root per zones had the object to separate the various biologically different regions.

From the apex towards the basis of the root, the fresh weight and dry-matter content of cells show a considerable increase in the root of the parent plants, i. e. wheat of hexaploid chromosome number and diploid rye. Increase of weight is observable also in octoploid amphidiploid hybrids which, however, invariably remains below that of any of the parent plants. NS—P per cell has a wide range in the parents (wheat: $6 - 30 \cdot 10^{-6}\,\gamma$; rye: $5 - 20 \cdot 10^{-6}\,\gamma$), while this range is somewhat narrower in amphidiploid hybrids ($10 - 17 \cdot 10^{-6}\,\gamma$). A similar variability can be observed in respect of the two NA-fractions. NA—P content, and especially DNA—P content per cell, gives a maximum curve for the examined 10 mm piece of root with a maximum value in the 6—8 mm zone. The DNA—P content is not constant in cells with equal chromosome numbers, nor does it change in proportion with increasing chromosome number. The theory which postulates a constancy of intracellular DNA—P finds, therefore no confirmation by these results.

INVESTIGATIONS CONCERNING THE PHYSIOLOGICAL DRYNESS OF RICE

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The safety of rice production in Hungary is highly jeopardized by "browning" ("Bruzone") a disease which assumes sometimes disastrous dimensions. Observations have shown that the disease arises only in unfavourable (cloudy, cool) weather and attacks particularly some varieties susceptible to it. No matter how abundantly rice fields are inundated, the plants affected fail to take up a sufficient amount of water and suffer from "physiological dryness".

The disease becomes particularly dangerous if it attacks the plant at a time when the reproductive organs are formed, i. e. when metabolism is especially intensive. Unfavourable atmospheric conditions which facilitate the incidence of Bruzone are known to approximately coincide in Hungary with this developmental period.

Biological experiments made on artifically cooled plots proved that some varieties of rice were more resistant to the disease than others. While the variety *Dunghan Shali* was destroyed almost totally, another variety, *Precoce Allorio*, known as resistant, though likewise affected by the disease, tolerated the lack of water much better.

That some varieties show more, others less tolerance has been corroborated by comparative biochemical experiments, especially concerning changes in the individual nitrogen fractions. Among others, it has been demonstrated that the free amino acids of each variety undergo changes according to the degree of damage which lack of water occasions in that particular variety.

So far, we have not been able to ascertain the physiological factors which cause different varieties to behave differently if affected by "physiological dryness". Developmental degree of the root (as related to that of the shoots), possibly the anatomical structure, the colloidal state of the protoplasm and perhaps other factors too may be responsible for these differences in behaviour. Nitrogen, a pathogenic factor in many cases, if given in larger quantities, affects the development of roots (and so the uptake of water) adversely. This points to a close connection between Bruzone and the appearance of physiological dryness.

STUDIES CONCERNING DAILY CHANGES IN THE SHOOT-ELONGATION RATE OF THE GRAPEVINE

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There exists only a limited number of studies dealing with daily changes in the rate of shoot elongation. According to the general opinion, light has a decisive role in the daily sequence of growth-rate changes; therefore, shoots grow better at night notwithstanding lower temperatures.

The growth of 8 shoots of *Vitis vinifera* (variety Leányka and Ezerjó) was measured during 54 hours at intervals of two hours, between the 18th and the 20th of May, 1959, in Budapest. Simultaneously also the temperature and the relative humidity were measured, and the intensity of light determined by means of a lux meter. The radiation-intensity ($gcal/cm^2$) data of the adjacent Meteorological Institute too, were taken into account. The effect of meteorological conditions on the shoot-elongation rate was examined graphically. Three of the environmental factors: temperature, light and radiation, changed nearly in parallel, but the curve of humidity run opposite to the others. The rate of shoot elongation changed rather irregularly but it can be well seen that the shoots grew more slowly at night than in the daytime. The growth rate of the shoots proved to be more or less dependent on the three former environmental factors. It may be seen from these data that, under the conditions investigated, the shoot-growth of the vine depends chiefly on the daily march of temperature, and only slightly on the inhibitory effect of light. It is probable that the irregularity of the changes in the rates are partly due to endogenous factors.

AFTER-EFFECT OF PHOTOPERIODIC TREATMENT ON HOP PLANTS

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Climatic conditions prevailing in hop-growing areas (South and Central Europe) lead to the conclusion that hop is a long-day plant. There occur, however, two varieties in Hungary: a variety with a longer and one with a shorter period of growth. Such difference in the period has given rise to the notion that it may be due to photoperiodic factors. With a view to studying the problem, the authors performed experiments with two varieties: the earlier Czechoslovak (probably Zatec) and the later French (probably Alsatian) variety. The test plants were exposed to daylight for 10 hours only during 15 days (from May 23 to June 7), while controls received the normal amount of daylight. To determine the effects of the treatment, phenological analyses were made and the rate of growth, the weight of the different body parts and the formation of lateral shoots were observed. Phenological data showed the florescence of treated plants to have been delayed by 2 to 3 days. This result would mean that both varieties are long-day plants. Observations concerning the rate of growth showed that the growth of the French variety was promoted, while that of the Czechoslovak variety inhibited. Analysis of body weight revealed that the treatment had rendered the French hop more generative and the Czechoslovak more vegetative. The development of lateral shoots was promoted in the latter variety. These results justify the conclusion that the French hop is a short-day, the Czechoslovak a long-day plant, although this conclusion is not supported by the phenological data. This may be due to the short duration of the treatment. It is therefore suggested that not merely phenological results should be considered in the evaluation of the effect of photoperiodic treatments.

ON THE CONDITIONS OF PRECIPITATION, TEMPERATURE AND AIR HUMIDITY NEEDED BY CERTAIN LARGER FUNGI FOR THE FORMATION OF FRUIT BODIES

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It seems that humidity and temperature are the most important ecological factors for the formation of fruit bodies of mushrooms. Provided that the fungus mycelium in the substrate is developed sufficiently and if there is a copious nutrient supply, the formation of fruit bodies starts as soon as the conditions of humidity and temperature turn favorable.

Of the mushrooms it is the *Psalliota campestris* in respect of which the ecological conditions required for the formation of the fruit bodies are well known. This species is growing well if the humidity of the substrate is about 60—70 p. c., the temperature of the ambient atmosphere 12 to 15 °C, and the relative humidity of the air about 90 p. c.

No such data are known in the case of wild-growing mushrooms. Author investigated the appearance of fungus fruit bodies over a period of eight years in the region of Gyömrő, east of Budapest. This area is situated on the south-west border of the Gödöllő hill country; its soil is loam, sandy-loam and sand.

The investigations included some 40 species of mushrooms, with 30 to 80 data for each species. Relying on the meteorological data concerning each particular day of collection and survey, the author determined the mean values of precipitation, temperature and atmospherical humidity in respect of a period of 5 days resp. of 10 days before the collecting day. The mean value of the 30 to 80 data collected in this manner gives a good approximation of the conditions required for the formation of fruit bodies of the examined species, in terms of average precipitations, temperature and air humidity. The interrelations and the absolute values of the data collected are in good accordance with practical experiences.

SAPROBIOLOGICAL SYSTEM OF ALGAE IN THE RIVER TISZA

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The purity of rivers presents a problem that has become increasingly significant since the end of the last century on account of the growing number of settlements and the progress of industrialization. To physical and chemical methods for the control of waters the new method of biological control has been added: it has the object to ascertain the degree of contamination by organic matter with the aid of indicator organisms, so-called saprobionts.

It was in the years 1908 and 1909 that KOLKWITZ and MARSSON introduced saprobiological water control, which made considerable progress during the last five decades.

The lessons of the revised system of saprobionts are well applicable to the biological control of Hungary's larger rivers. The river *Tisza*, though still less contaminated than most other larger rivers in Europe, is nevertheless exposed to the danger of becoming soon contamined on account of Hungary's growing industrialization in the course of which large works will be erected along its shores; it will, therefore, be necessary to institute a more careful system of the river's biological control. Utilizing the results of many years of algological research work and relying also on literary reports, the author has developed a saprobiological system of the algae living in the Tisza. He assumes that this is the kind of work by which research workers concerned with algology may best promote the work of saprobiologists. The saprobiological list compiled by the author contains data concerning 136 taxa. These are divided into larger taxonomical groups within which they are grouped according to their saprobitic properties. The degree of "saprobity" at which particular organisms produce the highest effect is specially indicated in the list which shows moreover the organisms that are the best indicators.

The detailed saprobiological list of algae in the river Tisza will shortly be published; further investigations may lead to certain additions and corrections, and it is hoped that the list will facilitate the success of saprobiological experiments to be started before long.

UNEQUAL DIVISION OF ALGAL CELLS

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The unequal division of the cells of several algae *(Euglena, Phacus, Trachelomonas, Oscillatoria, Chlamydomonas, Nautococcus, Ankistrodesmus, Ulothrix, Cladophora, Spirogyra)* both in nature and in laboratory cultures has been often observed by the author since the beginning of the thirties. The newly-formed cells differed from one another mostly in size, shape and structure. But also physiological differences could be observed in a number of cases: (1) the repeated division of two newly-formed cells did not take place simultaneously but at considerably different times. Some of the new cells underwent no more mitosis. (2) Some of the new cells responded to plasmolytic effects differently from others. (3) Given unfavourable conditions, there occurred differences in respect of vitality also. Differences of the latter kind were, for instance, very conspicuous in the case of the *Euglena gracilis* the succession cells of which had been long kept in wet-chamber preparations. It could not be proved that all cell divisions were of an unequal character. The newly-formed cells of the *Chlamydomonas intermedia* were sometimes morphologically equal. Their repeated division took however place at different times. Concerning the reason of unequal division, further researches are necessary. Beside the differences in age, polarity too may be involved. This form of division may in any case contribute to variability.

XYLOTOMY OF THE PANNONIAN BROWN COALS AT RUDABÁNYA

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The paper is the supplementary and final part of the author's reports on the results of microscopic analyses to which Hungarian tertiary ligneous brown stone coals were subjected since 1951. These investigations had the object to explore the brown coals from a palaeobotanic point of view, to elucidate the palaeophytic origin of the coal deposit.

The coal deposit of Rudabánya, a surface formation of a local iron-oar range, is situated between a layer of Upper Pannonian sphaerosiderite conglomerate and of Pleistocene red clay. A xylotomical examination of 50 samples collected from the deposit justifies the conclusion that the brown-coal bed in question derives mostly from the wood of trees of the Sequoia type among which *Taxodioxylon gypsaceum* Kräusel and *Glyptostroboxylon tenerum* Conventz were predominant. Some of the samples proved to be of palmaceous origin and can, thus, be termed as *Palmoxylon* sp. It is probable that a swamp forest developed on the increasingly water-logged coasts of the Pannonian inland sea in which Glyptostrobus was predominant. Adjacent to it, there existed a riparian, and next to the latter, a Sequoia forest at the foot of the hills, with palm groves here and there. The climate of those times would correspond to that of today at the boundary of the subtropical and Mediterranean zones, while the flora pertaining to it corresponds — in consideration of the Rózsaszentmárton material of equal age — to the so-called oligotropic flora.

SILICIFIED STEMS OF TREES FROM THE PALAEOGENE OF THE COAL-BASIN OF DOROG

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From the sand and sandstone beds of the Oligocene of the coal-basin at Dorog, about 70 silicified and carbonised parts of stems have passed into the collection of the Regional Museum of the Dorog district. The palaeogene coal-beds of the coal-basin being of thoroughly homogeneous consistence, investigations into the silicified and carbonised stems will throw some light upon the said flora.

Ginkgo stems dominate in the collected material. Besides several xylotomic marks characteristic of the *Ginkgo*, the typical druses too can be well observed. From among the Conifers, the *Sequoia* type could be determined in five cases.

Foliaceous trees are represented by *Laurinoxylon müllerstolli* GREGUSS, *Dryoxylon* sp., *Icacinoxylon* sp., *Cassioxylon* sp., and *Quercoxylon böchianum* (FÉLIX) MÜLLER—STOLL et MÄDEL. Very interesting is a still undetermined stem having pore-rays and longitudinal resin-passage. Such a structure is unknown among both recent and fossilized stems.

The collection contains also a very well preserved palm stem.

The finds reveal a decreasingly tropical flora.

ANTHRACOTOMIC INVESTIGATIONS ON MESOLITHIC (TARDENOISIEN) CHARCOAL REMAINS OF SZEKSZÁRD—PALÁNK

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In the loam-pit of the Szekszárd—Palánk Brick-Works, the remains of a mesolithic fire-place lying under Avar graves, were discovered in 1957 by VÉRTES. Part of the material found in the fireplace, charcoal pieces totalling 100, were forwarded in May, 1957, to the author who examined them all anthracotomically. Anatomical features having proved to be identical in all charcoals, their characters can be summed up as follows:

Growth rings are ring porous, the pores mainly solitary, but also twin pores occur frequently, and less frequently pore chains, too. Ground tissue composed of thin-walled fibre tracheids. Rays uniseriate and homogeneous, inasmuch as both the marginal and the inner cells are merenchymatic. In the crossing fields of the marginal cells, simple pits arranged in two tiers, present. Perforation simple, vessel walls thickened by bordered pits.

On the evidence of their anatomical characters, all examined charcoals were identified by the author as the remains of *Populus* sp. It is impossible to identify the species itself on a xylotomical basis. Features considered distinctive by HERMANN and GREGUSS, were recently shown among others also by SÁRKÁNY, STIEBER and FILLÓ to be extremely variable even within the individual.

The 100% occurrence of mesolithic *Populus* at Szekszárd—Palánk would point, in the first place, to the Praeboreal, i. e. the Alleröd period. However, taking into account especially the geographic and stratigraphic position of the site, it may be possible that the charcoals in question are remains of woods grown on river-banks or flood areas. In such places *Populus* might occur in any phase of the postglacial epoch and thus conclusions drawn with regard to phases in the history of vegetation, have to remain mere conjectures. It is for the first time, however, that mesolithic *Populus* charcoals have been recorded in Hungary.

THE EVOLUTIONARY SIGNIFICANCE OF THE ATAVISTIC ABERRATIONS OF THE BIRDS

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There may be observed, even at a cursory glance, abnormalities in the plumage of some Hungarian Passerine birds which deserve a thorough investigation. The aberrations present themselves in colour, pattern, and the relative size of the rectrices and remiges. Facts led me to the well supportable scientific hypothesis that the concomitantly arising aberrational features have an atavistic significance. Any verification of the atavistic nature of the aberrations render scientifically proved data to the phylogeny of the species in question. The results of the examinations led to the following, scientifically valuable, facts. Irregularities cannot be relegated either to colour aberrations of another nature, or to colour deviations arising as a

consequence of hybridization. At the present state of our knowledge, and with reference to the results of just the present atavistic-aberrational studies, it would be most appropriate to designate the investigated birds, for the time being, as a superspecies. Of the present studies we may establish the following rules. The higher the number, extent and intensity of atavistic-aberrational characters are in a given species, so much later did it separate from the one or more species to whose features it reverts, therefore the strength of the atavistic-aberrations is conditional on the age of the species. It also follows that a decrease of the atavistic-aberrations indicates the stabilization of the specific characters. If several characters of all species constituting a genus be observed among the atavistic-aberrational features of the one or other species, they denote that, on the one hand, the genus is of a homogeneous origin, and, on the other hand, the species exhibiting the mixed atavistic-aberrational peculiarities is in a flourishing state of specialization.

MALACO-COENOLOGICAL INVESTIGATIONS CONNECTED WITH MICROCLIMATOLOGICAL OBSERVATIONS ON THE SHORES OF THE RIVERS TISZA, BODROG AND KRASZNA

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Factors determining the environment of snails living in the flood plain and on the shores were investigated. Investigations were performed in summer. The investigated zones differ microclimatically and biologically very significantly from the surrounding parts of the Great Hungarian Plain and the adjacent flood areas. They are characterised through higher atmospheric humidity, moderate rise and drop of temperature resulting from the exposure of the terrain, the proximity of water, the vegetation and the properties of the soil.

Malacofauna is to be found only on the shores in the macroclimatically arid flood area between Tokaj and Rakamaz. It consists of hygrophilic ubiquitous elements; the number of species and individuals is small. Its occurrence forms no continous zones, it is confined to the tracts protected form the lateral erosion of the river, to areas with slightly sloping bed and to neutral tracts of the bank. The accumulation of deposits is small in these areas. The soil is a miry infusion loes. The water content of the soil is high: 30—35 weight percent. Near to the surface, the daily fluctuation of temperature is small. The area is protected against irradiation through continous shadow effects. No snails were found on the abrupt or the accreting banks. The following types of coenoses were observed: *Deroceras agreste*, *Zonitoides nitidus* type with *Vallonia pulchella* and *Zanobiella rubiginosa* as dominant elements at the Tisza. *Zonitoides nitidus* type without significant dominants at the Bodrog. At the Kraszna (in consequence of higher water content of the soil): *Succinea putris*, *Cochlicopa lubrica*, *Zenobiella rubiginosa* types with *Fructicola fruticum* and *Helix lutescens* as accessory elements.

It was found that, in consequence of the mosaic-like changes of the banks, no species could became absolutely constant. Therefore no coenological category higher than synusium could be established in respect of particular shorter tracts of the banks.

COMPARATIVE PLANKTOLOGIC INVESTIGATIONS IN THE BACKWATERS OF THE RIVER TISZA

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The author conducted planktologic researches during the summer season in 1957 and 1958 in 11 stagnant branches of the many that exist in the Hungarian portion of the river Tisza (Tiszafüred, Tiszaszeg, Szajol, Vezseny, Tiszaug, Nagykörü, Dinnyéshát, Kurca, Sasér, Mártély, Hattyastelep).

A comparative examination of the collected mesozooplankton *(Rotatoria, Entomostraca)* gave the following results:

As regards number of species and individuals, the mesozooplankton the examined branches of the river seems to be differently composed. A comparison of the given hydrographical conditions with the existing mesozooplankton shows that the quantity and quality of the vegetation produce a marked effect on the mesozooplankton. Dead arms of the river with deep water and without macrovegetation *(e. g.* at Mártély and Szajol) contain mesozooplankton of a lacustrine character, while the aquatic fauna of the shallow stagnant branches containing rich macrovegetation and much disintegrated organic matter *(e. g.* at Tiaszaug and Tiszafüred) has a paludine character. Waters of the first category are dominated by *Entomostraca*, those of the second category by *Rotatoria*. Apart from the latter, an increasing number of *Testaceae*, an order characteristic of marshes, is encountered.

A comparative scrutiny of the mesozooplankton existing in dead river arms reveals the process which takes place in the development of faunal associations in the course of the senescence of waters. Decrease in the amount of water, spreading vegetation, accumulation of organic debris induce a gradual modification of the original fauna so that it assumes first a lacustrine and later a paludine character.

Although the mesozooplankton of the examined waters contains but a limited number of species, those species which have succeeded in adjusting themselves to the special conditions of life in these waters contain a high number of individuals. To such species belong: *Lophocharis salpina*, *Platyias militaris*, *Keratella ticinensis*, *Lecane quadridentata*, *Scaridium longicaudum*, *Macrocyclops fuscus*, *Graptoleberis testudinaria*, *Pleuroxus laevis*, *Peracantha truncata*.

Beside the 48 species of *Rotatoria* and the 45 species of *Entomostraca*, encountered in the course of the investigations, new finds for the Hungarian fauna were the *Niphargus mediodanubialis*, *Chaetonotus chuni* and *Polymerurus nodifurcata*.

SELF CLEANING OF THE RIVER SAJÓ

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Abstract not received.

MICROBIOLOGICAL PROCESSES AND CLIMATICAL FACTORS INVOLVED IN THE DEATH OF FISH IN THE BACKWATERS OF THE RIVER TISZA

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A tremendous loss of fish in the backwaters of the river Tisza occurs in August.

Such damage is unknown in the limy backwaters of the Danube.

As the destruction appeared only in the shallow stretches and run off rapidlv, and since the dead fish did not infect the healthy population, the conclusion is justified that mortality was due to some mud poison and not to infectious microorganisms.

Investigating the direct cause of the death, it has been found that, mainly as a result of sulphate reduction a considerable amount of ferrous sulphide (8—29 mg/100 g) is formed in the mud of stagnant river arms. The decrease of pH-value releases molecular H_2S. The fall of atmospheric pressure greatly contributes to such a H_2S saturation of the water and is toxic to the fish. The upward pushing gases (CH_4, CO_2, H_2S) carry fine, colloidal particles of mud which make the water turbid. As long as there is oxygen in the water the ferrous-iron is oxidized into ferric oxide-hydroxide. Water is rusty-brown in such cases.

Hydrogen sulphide, as respiratory poison, kills the fish. Of course, H_2S concentration occurs first in the shallow stretches where conditions are favourable for the formation, accumulation and release of H_2S. The lethal quantity of H_2S ranges from 8 to 14 mg/litre according to species and depending on hydrographic and atmospheric conditions. The phenomenon in question is therefore no special fish-disease but a general poisoning that is over in a few days. Lime (CaO), copper sulphate and calcium nitrate seem to be promising as a prevention of the formation of hydrogen sulphide.

HISTOLOGICAL AND HISTOCHEMICAL EXAMINATION OF TUNIC FORMATION ON THE CIONA INTESTINALIS

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A total of 50 animals were fixed in alcohol, in Bouin's, SUSA and Sannomiya's fixing fluid, further in 10% formalin and then embedded in paraffin. Staining was performed with alcianblue, astrablau, per-iodic acid Schiff-reaction and acridine orange fluorescent stain as described by Hicks and Matthaei.

Acid mucopolysaccharide content was found to be significant in the inner layers of the tunic, less pronounced in the middle and negligible in the outer layers.

Merocrine secretion is observable in many of the goblet-like epidermal cells which are involved in the formation of the tunic; the secretion invariably contains acid mucopolysaccharides. This secretion is particularly intensive in the epidermal crypts. The secretion of the goblet cells is connected with the freshly formed fibres which always contain mucopolysaccharides.

Mucopolysaccharides are sometimes demonstrable even in detaching epidermal cells. It is suggested that these cells play no longer any part in the production of the tunic when getting access to its substance.

Stained with astrablau, the mesenchymal cells of the tunic do not reveal the presence of acid mucopolysaccharides but a strongly positive response to PAS. PAS-positive granules are observable in some cells, while no granules can be seen in others which seem to be surrounded by delicate filamentous figures containing acid mucopolysaccharides. This phenomenon may be connected with cellular function.

ANTHROPOLOGY OF THE POPULATION OF SÁRKÖZ AND SZEREMLE

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Abstract not received.

SOME QUANTITATIVE CHARACTERS IN DIFFERENT AGE GROUPS OF RURAL ADULTS

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Examining 240 males and 211 females, *i. e.* a total of 451 persons who had passed their 18th year of age, the authors ascertained the following data: body height, length and width of head; width and height of face; height, width and depth of nose; position of ear; length-width and length-height index of the head; facial and nasal index. The examined persons were divided into three age groups: group I from 18 to 40; group II from 41 to 64; group III above 65 years of age. The ascertained indexes were grouped likewise.

The average height of the males was found to belong 164.62 cm, that of the females 152.55 cm. The former belong to the group of middle stature, the latter to that of small middle stature. The members of group III are considerably lower than the males of either group I or of group II (D I—III: 6.93 $\pm$ 1.5 cm; D II—III: 5.12 $\pm$ 1.43 cm). There are considerable differences between the female groups also, i. e. between the young and aged groups (D I—III: 7,01 $\pm$ 1,26 cm), between the middle aged and aged groups (D II—III: 3.52 $\pm$ 1.24 cm) and between the young and middle aged groups (D I—II: 3.49 $\pm$ 0.98 cm). The said differences between the male groups can be verified statistically; in the female groups only the differences between I and III and those between I and II are statistically significant, while differences

between female groups II and III are only probable. Paying due regard to existing further differences, the paper enumerates each particular characteristic in respect of both males and females. Deviations between male groups II and III in respect of all cranial measurements do not exceed the threefold of the margin of error. It is only in respect of the nasal width that verified differences exist between male groups I and II and between I and III since older persons have wider noses (D I—II: -1.72 ± 0.45 cm; D I—III: -2.57 ± 0.61 cm).

No difference between the age groups could be observed in regard of the ascertained indexes.

Differences of measurement in respect of females were similar to those of the male groups. It was in respect of nasal width that differences between female groups I and II and between I and III were found to approach statistical authenticity (D I—II: -1.17 ± 0.40; D I—III. -1.73 ± 0.64 cm).

Indexes per groups did not show demonstrable differences among females either.

As a conclusion, it can be stated that — except body height and nasal width — it is possible to make a uniform evaluation of the results in respect of the other quantitative characteristics as far as the said material and the said age groups are concerned.

N-DETERMINATIONS FROM HISTORICAL BONE FINDINGS

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Abstract not received.

SOME DATA ON THE GROWTH OF SCHOOL CHILDREN

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Author measured two groups of children in the elementary school of the village Hajdusámson, between 1951 and 1959. He examined one of the groups from 1951 to 1959, and the other from 1952 to 1959. He collected data concerning the children at the beginning of each school-year. He was thus able to study changes in the body-proportions of the same children over 8 years.

The data recorded were the body-height, breadth of shoulders and pelvis, circumference of chest and body-weight. The mean values of all groups are essentially higher than those from the year 1951 alone. Author calculated the parameters of the minus-variants and plus-variants separately. Minus-variants mean the children who are shorter and plus-variants those taller than the average. The experience was that in cartain periods the plus-variants and in others the minus-variants showed greater annual relative growth.

The plus-variants lived under significantly better conditions, *i. e.* in more favourable environment.

SOME PROBLEMS OF GROWTH IN CHILDREN

O. Eiben

SZOMBATHELY

Abstract not received.

A CRITICAL STUDY ON VOLUTER'S METHOD FOR IDENTIFICATION OF RERSONS ON THE BASIS OF SCULL X-RADIOGRAPHS

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VOLUTER introduced a new method for identification of persons killed in air crushes. On lateral scull radiographs the following measurements are taken: *a)* surface of sella, *b)* of the sphenoidal sinus, *c)* distances of glabella-bregma, glabella-vertex, glabella-gonion, glabella-nasospinale, resp. gnathion, glabellaiion, *d)* distances of bregma-sellion, vertex-lambda, vertex-inion, *e)* distances of lambda-inion, inion-gonion-gnathion.

In the present study the method was revised and compared with other craniotrigonometric methods.

The surface of the sella proved to be a function of age in childhood. Straight lines connecting the two (anterior and posterior) margins of the sella with the bregma, resp. opisthocranion form angles characterising the size of the sella. Another important angle is formed by straigth lines connecting the porion with the sella. These values allow the calculation of the sellar size.

No correlations were found between external scull measurements and the surface of the sella and the sphenoidal sinus. The latter value is not a function of the former.

The present study corroborated the findings of VOLUTER. Authors suggest the use of their nomograms to obtain comparable numerical values. The method of VOLUTER is, in consequence, suitable for its proposed application if restrictions of the method and the results of a study on sutures and prognathism are also taken into consideration.

STUDIES ON COMPARATIVE GERONTOLOGY IN INVERTEBRATES

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Abstract not received.

COMPARATIVE STUDIES OF DIFFERENT EFFECTS OF EXOGENOUS SEROTONIN (5-HYDROXYTRYPTAMINE) ON YOUNG AND OLD RATS

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The effect of serotonin on O_2-consumption, body temperature, and blood picture of old and young rats was studied. No significant difference was found to exist between the basal metabolism (O_2-consumption) of old and young rats at an ambient temperature of 20° C. At the same ambient temperature, the decrease in O_2-consumption is significantly greater in young than in old rats in the first hour after the s. c. administration of 5 mg/kg of serotonin-creatinine-sulphate. This difference is no longer significant in the 2nd and 3rd hour after the injection. In the same way, after the injection of the same dose of serotonin, decrease in the body temperature of young rats is more pronounced than in that of old animals.

Studying the blood picture after giving the same dose of serotonin, a difference could be observed between the change in the number of platelets of young and old rats. Though the platelet count in rats shows great spontaneous fluctuations, we observed in our experiments that it greatly diminished in young rats 30 minutes after the injection of the abovementioned dose of serotonin, while this effect was less pronounced in older rats.

FURTHER STUDIES ON THE PANCREATIC CHANGES IN OLD AGE

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In the past year the authors reported on the very frequent incidence of dyschylic changes in the pancreas of old persons. In the present studies the post-mortem analysis was supplemented by studies of the pancreas from the experimental animals and it was found that above mentioned changes did not occur in untreated young albino rats. When, however, the young rat was subjected to neurotraumatisation and the experiment was continued for 10 months very severe pancreatic changes developed. These changes were characterized by a vacuolisation in the acinar epithelium, flattening of cells and appearance in their centre of a material staining homogenously, and sometimes showing metachromasy. In many cases a similar metachromatic substance appeared in the efferent ducts as well. Exposure to electrical current alone did not produce such changes. It is suggested that the dyschylic changes of the pancreas may be produced not only by the diseases affecting the individual during life or causing death, but also by nervous traumatisation suffered during life, as it is proved by the experiments made.

Abstracts of papers read at the sessions of the Section B

ELECTRON MICROSCOPIC OBSERVATIONS ON THE PHOTORECEPTOR STRUCTURES OF SEVERAL TURBELLARIAN SPECIES

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The fine structure of the eye of the planarians *Dugesia lugubris* and *Dendrocoelum lacteum* was studied under the electron microscope. The primitive eye which belongs to the simplest visual organs in the animal kingdom consists of a pigment-cup formed by one or more pigment cells and of the specialized end organs of the bipolar retinal cells. These cells are situated in the neighbourhood of the eye and send a central process into the head ganglion.

The ultrastructure of the club-like ending of the retinal cell, the so-called retinal club, was investigated. The core of the club, directly continuous with the nerve fibre, is filled with cytoplasm matrix and, embedded into it, with numerous mitochondria, granules and small vacuoles of various size. The mitochondrial lamellae are mainly longitudinally oriented, similarly to those described in other nerve endings by various authors.

The marginal zone of the retinal club is occupied by a system of long, parallelly arranged tubules radiating from the club-core towards the periphery of the club. The diameter of the tubules varies from 200 to 800 Å; their length cannot be exactly measured, but tubules reaching the length of several μ were often observed. The relation of the tubules to the club-core is not yet clear, but often a direct continuity between the core cytoplasm and the content of the tubules could be found which indicates that the tubules may be regarded as long processes or microvilli of the nerve ending and the whole tubular system as a type of a high brush-border. We consider this structure very suitable for photoreception; similar photoreceptor structures were described in arthropods and cephalopods.

Vacuoles of various sizes were consistently observed in the club-core, especially in the zone between the core and the tubular system. They show a very light content and have the tendency to fuse with those of neighbouring vacuoles. Experiments to clear their physiological role are in progress.

SUBMICROSCOPIC STRUCTURE AND HISTOPHYSIOLOGY OF THE HARDERIAN GLAND OF THE RAT

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In order to study the phenomenon of chromodacryorrhoea in the rat, the submicroscopic structure of the gland and the biosynthesis of the porphyrins were examined.

In the cells of the gland there are sudanophil vesicles rich in lipids. They can be recognized under the polarisation microscope in the form of positive polarisation crosses.

It is remarkable that under the influence of methanol the sudanophilia of the cells is abolished, while their birefringence is retained.

Under the electron microscope, globules of the size of 0.25—2.0 micron may be observed in native homogenates of the gland. In ultrathin sections, the vesicles result from the coalescence of similar but smaller elements, the latter having a distinct osmiophil bordering layer. These layers seem to disappear gradually in the larger vesicles.

POLARISATION-OPTICAL OBSERVATIONS CONCERNING THE DEGRADATION OF DESOXYRIBONUCLEIC ACID

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According to earlier observations some acridine dyes give an anisotropic staining-reaction with tissue nucleic acids in situ. In vitro experiments have now shown that certain basic dyes precipitate polymeric nucleic acids from their solution in the form of anisotropic threads.

In the present experiments an attempt was made to find out whether or not the thread-like oriented precipitation of desoxyribonucleic acid (DNA) was dependent upon the polymerism of the molecule which viscosimetric determinations seemed to suggest.

The authors examined the changes in the course of anisotropic precipitation of dyes at different stages of pretreatment of DNA with (1) heat, (2) acids and formalin, and (3) enzymes.

It was only in the case of certain dyes that changes parallel with the results of viscosimetric estimations were observed and that threadlike precipitates were still obtained with advancing degradation, while, in the early stages of degradation, the majority of dyes precipitated DNA as an amorphic dust.

Therefore, the disappearance of anisotropic precipitates, *i. e.* the appearance of granular precipitates, is regarded as an early optical sign of degradation.

ELECTRON MICROSCOPY OF INTRACELLULAR DIGESTION IN A CILIATE (TETRAHYMENA CORLISSI)

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Cells of *T. corlissi*, grown axenically on a tryptone broth were fed on fresh frozen sections of mammalian spleen. The animals readily ingested this tissue. Unfed and fed animals, as well as animals starved after feeding, were fixed in osmic acid and embedded in methacrylate. Ultrathin sections were studied under the electron microscope.

There are but few, rather empty vacuoles in the unfed animals. The number of food vacuoles in the fed individuals rapidly increases with advancing food-uptake. All vacuoles are surrounded by a double membrane of 75 Å in thickness. The original structure of the ingested tissues can never be recognized, a fact pointing to a certain extracellular "predigestion". The recently formed ingestion-vacuoles contain granular material rapidly condensing into a dark homogeneous mass. Later, the vacuole increases in size, its walls are lifted from the dark vacuolar content. The latter breaks up slowly to disappear thereafter almost entirely. At the same time, a great number of small secondary vacuoles are budding off from the wall of the digestion-vacoule. This process of intracellular pinocytosis must play a prominent role in the uptake of digestion products.

THE INNERVATION OF INSECT FLIGHT MUSCLES

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The motor innervation of the flight muscle (f. m.) in *Oxytelus latro*, *Apis mellifica* (Hymenoptera), *Lucanus cervus* and *Cetonia aurata* (Coleoptera) has been investigated by GÖMÖRI's *a*-naphtylacetate, KOELLE—FRIEDENWALD's acetylthiocholineiodide (for esterases and cholinesterases) and the gold chloride-impregnation techniques. Striking differences

of the innervation pattern between flight and leg muscle have been observed. No "Doyére-cone"-like motor ending has been found in the f. m. a type of innervation characteristic of leg muscle innervation. Another difference is that, in the leg muscles, each individual motor ending receives sometimes 2 or, more frequently, 3 or 4 axons ("slow" and "fast" system), while in the f. m. each muscle unit is always innervated only by 2 axons which run side by side to the point of their terminal ramification. The f. m. nerve, after entering the muscle unit, runs between the rather thick muscle fibres parallel to their longitudinal axis. From these longitudinal fibres, at intervals of about 30—70 micra, preterminal branches originate which approach the surface of the muscle fibres at nearly right angles. By further ramification, they break up into terminal fibres which attach themselves very closely to the muscle fibre-surface and have there a mainly circular course. The terminal branches do not penetrate through the sarcolemma but have nevertheless a very close relation to the large myofibrils lying on the surface of the fibre. Regular varicose swellings of these terminal fibres are seen at the site of crossing the furrows between two neighbouring myofibrils. Cholinesterases are found in high concentration in the larger axons but they can be demonstrated also in the swellings of the terminal fibres. Strange vacuoles of about 10 micra in diameter, distributed along preterminal and terminal nerve branches especially in the neighbourhood of fibre ramifications, but always closely attached to the muscle fibre surface, can be seen in large numbers in cholinesterase preparations due to a particularly high concentration of the enzyme. These cholinesterases differ — in respect of their sensitivity to cholinesterase inhibitors — considerably from generally-known acetylcholinesterases and non-specific esterases.

HISTOLOGICAL, HISTOCHEMICAL AND CYTOLOGICAL EXAMINATIONS ON THE CENTRAL NERVOUS SYSTEM OF THE SWIMMING BEETLE (DYTISCUS MARGINALIS)

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As proved by various staining, impregnation and histochemical methods both the brain and ganglia consist of two parts. The outer is built up from nerve cells, the inner is formed by nerve fibres. The nerve cells are unipolar. Some are larger, others quite small. Cells of different size form groups. The processes of the ganglion-cells are thin, neurofibril-like, occasionally strongly varicose. Neurofibrils are seen neither in the cells nor in the processes. The nervous system shows neuronal pattern. Neither in the central part nor peripherally is there a reticulum and there is no anastomosis or fusion between the cells. Synapses are seen in the central body and the trabeculi of the corpora pedunculata. Significant amounts of acid lipids are in the brain and in the ganglia peripherally. Phosphatase is found in large amount both in the brain and ganglia, in the cellular and fibrous parts alike. Also large amounts of acid phosphatase occur in the brain and ganglia, in large quantity in the periphery. Acid mucosaccharide-granules were found in the brain-cells. Glycogen occurs in larger quantities both in the brain and the ganglia. Vitamin-C is present in both brain and ganglia. Desoxyribonucleic acid has been found in considerable quantities in the cytoplasm and the nuclei of the brain and ganglion cells. Cholinesterase activity was observed everywhere. Succinic dehydrogenase occurs in larger quantities in the brain than in the ganglia. Iron was found in the nerve cells of the brain. Calcium is present both in the brain and ganglia in the central part. Mitochondria appear in the form of smaller and larger granules. A neurosecretory process was noted in the large cells in the anterior part to the protocerebrum. These cells are full of Gömöri-positive granules. The larger granules are situated on the edge of the cytoplasm in silver preparations and are visible also on the processes. The Nissl granules are grouped in the inner part of the cytoplasm.

NERVE-ENDINGS IN THE SKIN OF BIRDS

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By means of the silver-impregnation method, the following nerve-endings could be demonstrated in the skin of various birds: intraepithelial fibres, Herbst bodies, tree-like free ramifications, nerve-end plexuses in the arrectores plumarum and in the vessels and sensory end-systems around the barrel of the feather. Intraepithelial fibres have been found only in the skin of the bill of birds of prey, parrots and of pigeons. Herbst bodies, in contrast to literary data, have been found not only in the skin of the bill of aquatic birds but also around the meatus nasi of pigeons, parrots and birds of prey, in the feathery areas of all the birds, in the cloaca and in the skin covering the tarsometatarsus except the Passeriformes. The size of the Herbst bodies is fairly different, it is generally smaller in the skin of the bill than in the feathery areas. They are thickest in the skin of the bill of birds belonging to the Anseriformes. In the Herbst body, the axon runs straight without side-branches, ending in a round or elliptic end-head wherein sometimes a neurofibrillar structure can be seen. Grandry bodies are the specific end-bodies of the Anseriformes. The gallery-like arrangement of the tactile cells is most conspicuous at the edge of the bill, especially in geese. There is no neural connection between the neruofibrillar end-plate and the cytoplasm of the tactile cells. Tree-like ramifications can be often noted in the loose connective tissue of the corium. They are particularly numerous in the skin of the eye-lids. The arrectores plumarum and the vessels of the skin are innervated by the fibres of the vegetative nervous system which terminate in an end-plexus and not in a terminal reticulum. In the endplexuses endings may also appear in the form of end-heads. The innervation of the feathers is generally poor, sensory end-systems can be found only at the lower part of the feathers which are passing over from the skin of the bill to the skin of the head and in the papilla of the growing feathers.

EXPERIMENTAL STUDIES ON THE CAT HEART VAGUS

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In order to clear up the interrelations between vagus and heart, experiments with cats have been made by the author. He performed unilateral and bilateral vagotomy both below and above the ganglion nodosum vagi, and he also transected both bilateral depressor nerves. Unilateral vagotomy proved that the nervus vagus ends mostly on the same side, with its greater part in the atrium, and issues only a few fibres to the ventricle. An interlacement of the bilateral vagus-branches is fairly rare. Following bilateral vagotomy, a degeneration of the sensory end-formations of the vagus could be demonstrated in all histological layers, the most marked at the inflow of the large veins into the endocardium, *i. e.* into the epicardium of the ventricles. The degeneration of the divided fibres appeared in a typical form; specific degeneration was observed in one of the endings of the endocardium where — in spite of the total disintegration of the medullary sheath and of the axon — the end-system remained intact even after 268 hours following transection. Pictures of the transected bilateral depressor nerve prove that some end-types found in the heart have a structure identical with the end-formations of the pressoreceptor found in the arcus aortae. Since, certain end-sytems remained perfectly unimpaired after bilateral vagotomy, a participation of nerve fibres of spinal origin in the sensory innervation of the heart must be taken into account. The motor fibres of the vagus could be well traced up to the parietal ganglion of the heart where the synapses appeared strikingly in various forms of endings.

THE SUBCOMMISSURAL ORGAN AND THE NEUROSECRETION IN VERTEBRATES

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The subcommissural organs of fish, amphibia, birds and mammals have been studied.

The ependymal cells of the subcommissural organ are ordered in several rows. Each row is composed of cells of different type. The Gömöri-positive secretion may appear in each type of cell in the apical or in the basal form.

With due regard to those outlined above the secretion characters of the various species have been described.

Comparing the species with each other, it has been found that the amphibia exhibited the most intense function extending to all types of secretion. This is believed to be in connection with the oecological conditions of the given species.

The appearance of the second and third cell row has been correlated with a differentiation, during phylogeny.

THE ROLE OF THE NERVOUS SYSTEM IN THE MAINTENANCE OF THE RIBONUCLEIC ACID AND DESOXYRIBONUCLEIC ACID CONTENT OF STRIATED MUSCLE TISSUE

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The effect of neurotomy and tenotomy on the nucleic acid content of striated muscles of albino rats and Amphibia was studied. The experimental investigations supplied the following evidence.

As determined on the 3rd, 7th and 12th days after denervation the DNA content increased and the RNA content decreased. The increase of DNA content is associated with an increase in the number of subsarcolemmal nuclei. Elimination of the sympathetic innervation cannot be held responsible for the effects observed. The neurotomy-induced changes in the nucleic acid content of muscles are significantly different from those caused by tenotomy, from which it may be concluded that trophic nervous effects play a significant role in the nucleic acid metabolism of striated muscles. There was no significant change in the nucleic acid metabolism of striated muscles. There was no significant change in the nucleic acid content of the gastrocnemius muscle of *Rana esculenta* on the 3rd and 12th days following neurotomy and tenotomy, respectively.

ON CHANGES IN THE STRUCTURE OF CONTRACTILE PROTEINS IN PHYLOGENY

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It is an open question whether the contractile proteins of animals have the same structure at different stages of phylogeny or show similarity only in some of their main features. The solution of this question was approached by means of immunological methods: rabbits were immunized with myosin preparations obtained from different animals, whereas roosters were immunized with rabbit-myosin. While immune sera from roosters, immunized with rabbit-myosin, precipitated the examined mammal myosins, they did not react either with the myosin antigens from fowl or frog or, generally, with those from lower species. Sera of rabbits immunized with rooster-myosin precipitated only fowl-myosins and did not react either with the myosin from mammals or from various cold-blooded animals. The clam-myosin antisera precipitate not only homologous antigen but also myosins extracted from the muscle of snail and earthworm, though at a lower titre.

In the case of higher animals, the results reveal a distinct class specificity, while these limits become indistinct in the tonic muscle of lower animals. According to the author's earlier data, the structure of contractile proteins is dependent on the tonic or tetanic type of activity of the muscle; in other words, the myosins of muscles performing tonic function differ characteristically from those of tetanic muscles. It is, therefore, quite probable that the tonic muscles possess a myosin of phylogenetically lower structure, while the structure of myosin from tetanic muscles is more differentiated, so that they obviously reflect also class-variations.

A STUDY OF COLLAGEN FIBRES PRECIPITATED IN VITRO, WITH SPECIAL REFERENCE TO THE QUANTITATIVE AND QUALITATIVE CHARACTER OF CHONDROITINSULFURIC ACID

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The author examined the effect of chondroitinsulfuric acid (ChSA) on fibrillogenesis in vitro. The basic experiment was as follows: a 0.01 M acetic acid solution of collagen was added to ChSA, the resulting fibrous precipitate centrifuged after 15 minutes and its chemical composition examined (for total protein, collagen protein and ChSa). When the quantity and/or polymerism of ChSA were changed the following could be observed:

(1) When the amount of collagen was kept constant and that of ChSA increased (to 10 : 0.3—30), the quantity of precipitated fibres, *i. e.* their ChSA content, rose. When the ratio collagen/ChSA exceeded 10 : 2.6, no more increase in the quantity of precipitated collagen protein could be observed.

(2) If to equal quantities of collagen equal but enzymatically differently depolymerized quantities of ChSA were added (10 : 2.6), the amount of the precipitated fibres first increased and then decreased and — at a certain degree of depolymerization — the ChSA solution failed to precipitate fibres any longer.

The depolymerization of ChSA was followed by MEYER's turbidity reaction, a metachromatic reaction, rivanol-binding, and by the determination of reducing power in glucose mg%; it was found that degradation occurred in three stages. The techniques here used offer a possibility of characterizing a functional property (ability to form fibrils) of a ChSA of unknown polymerism.

CHANGES IN THE DNA/RNA RATIO IN PENICILLIN-TREATED TETRAHYMENA PYRIFORMIS

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It is known from earlier communications that in consequence of penicillin treatment, *Tetrahymena pyriformis* changes its cell proportions, and that parallel changes are found also in its nucleus. These results were the starting point of the authors' recent investigations during which they determined the amount and distributional ratio of nucleic acids in penicillin-treated and in control animals. They ascertained simultaneously the changes that penicillin had induced in the nucleo-plasmatic relation.

The results of their experiments made it evident that the value of the DNA/RNA ratio was very high (1.271) in animals bred in penicillin-containing (500 U/ml) culture media, while this value was much lower (0.747) in the controls. The values of nucleo-plasmatic relations were similar, i. e. 0,2024 in penicillin-containing, and 0.1153 in control media.

The originally penicillin-treated animals showed normal (0.712) DNA/RNA ratio after being replaced into normal culture media, while nucelo-plasmatic relation returned near to normal (0.1026) only five days after the normalization of the media. These results suggest that penicillin causes a "Dauermodifikation" in the above-mentioned characters.

STUDIES ON THYMUS METABOLISM WITH LABELLED PHOSPHORUS

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Abstract not received.

METACHROMATIC STUDIES OF THE BLOOD CELLS FROM VARIOUS MAMMALIAN SPECIES

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The histochemistry of nucleoproteins is now in the focus of interest in pertaining research. Comparative studies, that may supply the answers to the problems of heterogenity gaining an ever increasing importance, appear to merit particular attention. In such investigations the authors have found the method of examining the metachromasy of the cell nuclei a prominently suitable test.

In authors' own experiments the phenomenon of metachromasy in the nucleated erythrocytes of fish *(Cyprinus carpio)*, amphibia *(Pleurodeles waltlii, Rana esculenta)* and birds *(Columba domestica, Gallus domesticus)* was studied after various kinds of treatment, staining the preparations with toluidine blue, azur A and thionine. The treatments employed were: 1. exposure to normal HCl at 20° C and 60° C from one to twentyfive minutes. 2. Treatment with 10 per cent perchloric acid at 60° C for periods of from 1 to 25 minutes. 3. Digestion with trypsin, at a concentration of 0.3 mg/ml, at pH 6.7, 37 °C, for periods of from 1 to 25 minutes. Moreover, model experiments were made, placing on strips of filter paper dropwise 0.375 per cent (for protein) horse serum, 0.375 per cent desoxyribonucleic acid (Light) and heparin (1 mg/ml). The models were treated in the same way as the blood smears.

As compared with the controls, the preparations exhibited multiple changes. After treatment with HCl at 20 °C no metachromasy was visible in the blood smears. However, all of the other treatments caused metachromasy of the red cell nuclei in every species tested. The nuclei of fish and avian red cells became metachromatic after a very short treatment. In the model preparations, even in those untreated, metachromasy was visible in the area corresponding to the spot of desoxyribonucleic acid.

It is concluded that the nucleoproteins of the nucelated red cells from different species are not equivalant with one another in respect of metachromatic staining. However, it appears that the same groups, the phosphates incorporated into the nucleic acid chain, which are released by treatment, are apparently responsible for the metachromasy.

PROMOTION OF VASCULARIZATION WITH ADRENAL EXTRACTS ON PIECES OF UMBILICAL CORD EXPLANTED TO CHORIOALLANTOIC MEMBRANE

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Although the vascularization of certain organs has been morphologically examined by many authors, no literary data seem to exist regarding the problem whether it is possible to oblige the organism to promote vascularization. Authors approached this problem by explanting different tissues (pieces of tissues) previously saturated with the following substances or their combinations: protoporphyrin, histamine (peremine), vitamin C, progesterone (glanducorpin), placental extract (choriogonin), extracts of pancreas, liver and adrenal, DOCA, thyreotropic hormone (Primothyron), derivates of dicumarin (antithrombosin), concoction of camomile, novocain, corbocain and lidocain. Umbilical cord, cartilage, brain, liver, pancreas, parathyroid and thyroid gland, as well as hypophysis served as explants.

The grafts were explanted on the chorioallantoic membrane of hen eggs incubated previously for 9—11 days. The duration of the explantation was 2—8 days. The explants were fixed in Susa fluid, embedded in paraffin, serially sectioned and stained with the usual histological methods.

The chorioallantoic vessels did not grow into the untreated bradytrophic tissues (umbilical cord, cartilage). Of the substances listed above, protoporphyrin had the effect of inducing a slight ingrowth of vessels in the peripheral parts of the bradytrophic tissue. The chorioallantoic vessels were found to organize if the piece of umbilical cord had previously been soaked with physiological saline extract of rat adrenal homogenates. A certain degree of vascular ingrowth was observed in the developing cartilage, too.

HAEMODYNAMIC DATA CONCERNING THE ORIGIN OF THE CONGENITAL HYPERTROPHY OF EXTREMITIES

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The pathomechanism of the hypertrophy of extremities due to congenital arteriovenous fistulae is not yet clear. It is an open question whether it occurs as a result of the more rapid flow of arterial blood or if it is caused by venous congestion. Authors studied the pathophysiological role of the latter.

The vena femoralis of 20 young rabbits was ligated and a comparative examination performed after two months. Hypertrophy of the extremity was observed on the side of the ligature in 17 cases, showing an average increase of its length by as much as 3 mm. The hypertrophy extended to the skeleton as well. It can be stated on the evidence of comparative arteriograms that the arterial network is richer and enlarged on the side of the venous ligature. Comparative radiocirculographic examinations were performed with I^{131}-labelled albumin on five animals with hypertrophic extremity. In four cases, the time of circulation in the extremity was shortened in a significant manner. The quantity of I^{131}-labelled albumin circulating in the extremities during a unit of time was determined. Increase in the operated extremity could be observed in three cases.

It seems reasonable to presume on the strength of experiments that, in young animals, the Sucquet-Hoyer precapillary shunts are opened by the ligature of the main venous trunk of one of the extremities and that thus a permanent artificial arteriovenous communication on a precapillary level is formed. The quantity of circulating blood increases as a consequence. From the point of view of the congenital hypertrophy of extremities, venous congestion cannot be discussed separately from the circulation of the extremity as a whole.

OXYGEN CONSUMPTION OF THE LARVAE OF TWO PREDATORY FISHES AT DIFFERENT TEMPERATURES

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Abstract not received.

OXYGEN CONSUMPTION OF DIFFERENT RACES AND HYBRIDS OF BOMBYX MORI L.

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Abstract not received.

THE APPLICATION OF AN X-RAY PHOTOMETRIC METHOD FOR THE DETERMINATION OF BONE DENSITY

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An attempt was made in recent years by the author with a view to base the determination of the content of mineral substances in the bones on a more solid foundation.

The accuracy of our photometric examination depends on the validity of two premises. These are: (a) the optical density of the roentgenogram of a given bone is directly proportionate to its mineral substance content; (b) by using a standard of known mineral-substance content, which is similar to the chemical composition of the bone and placed on the photographic plate at the time of exposure, it is possible to calculate a correction necessary because of the minor variations inevitable in photographic processes.

The first step of our procedure is to fix the photographic plate under the part of the bone which is to be examined. The energy of the exposure is regulated according to the thickness of the structure. Before making the exposure, the calibrated bone-standard has to be placed upon the photographic plate.

After making the exposure, the film is developed, fixed, washed and dried in a standardized manner. Thereafter the desired area of the X-ray picture of the bone is placed under the aperture of a photoelectric osseometer specially constructed for this purpose and the amplitude of the galvanometer's oscillation is noted. This amplitude increases with the amount of light let through the given area of the X-ray picture, while the latter (*i. e.* the permeated amount of light) is the function of the amount of mineral substances. The next step is to place the picture of the bone-standard into the osseometer and by succesively illuminating its areas of different optical density setting the galvanometer's hand in a position which corresponds to that obtained before by the bone-picture itself. Hence the mineral-substance content of the given bone is calculated in mg/mm^2 by means of interpolation.

According to the procedure described above quantitative determinations were carried out by the author on the bones of living and dead animals. The results were found to be saticfactory.

WATER-SOLUBLE GLYCOMETACRYLATE EMBEDDING FOR ULTRATHIN SECTIONS

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Glycometacrylate, in its monomeric form, mixes readily with water and can, therefore, be polymerized in all proportions. Ammonium persulfate is used as catalyst in the process of polymerization. Polymerization is produced by heat or ultraviolet rays within 12 to 24 hours.

Glycometacrylate in its polymeric form is insoluble in organic solvents. The material can be embedded in two ways for the purposes of electron microscopic examinations:

(a) Glycometacrylate is concentrated up to the pure monomer; (b) its different aqueous dilutions are polymerized stepwise. Decrease in the volume of the material does not exceed 8 per cent in the course of polymerization. Glycometacrylate may be employed also for the embedding of simple histological sections.

ADDITIONAL DATA REGARDING THE NATURAL AND LASTING HETEROKARYOSIS OF STREPTOMYCES

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Earlier investigations of the author concerned the heterokaryotic state of a single species only. To be able to study this phenomenon more closely, five recently isolated heterokaryotic species have been examined. After crushing them by means of glass beads, they were plated and cultured. Results observed: heterokaryosis generally modifies antibiotic production and changes the colour of both aerial and substrate mycelium in the isolated strains. We found both extremes in the forms isolated from heterokaryonts: the capacity of antibiotic production and, consequently, the bacterial spectrum seemed to be considerably intensified or considerably lessened. It is microscopic morphology on which heterokaryosis produces the slightest effect. This character seems, therefore, to be decisive for determination. Certain enzymatic reactions suffer a slight change under the effect of heterokaryosis. Separated strains that had been found pure were mated anew which enabled us to obtain a clear view of the transitory forms. If, for instance, organisms provided with white are crossed with those possessing dark grey aerial mycelium, a whole series of grey can be observed. The question whether nuclear fusion in the heterokaryonts and so the genesis of a new hybrid variety is possible still remains open. It is likewise open to doubt whether very extreme mutations, as described in literature, were not cases of heterokaryonts exposed to radiation.

EXPERIMENTS FOR THE PRODUCTION OF HETEROSIS SUDAN GRASS BY UTILIZING POLLEN STERILITY

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Crosses between varieties of Sudan grass (*Sorghum vulgare* PERS. var. *sudanense* STAPF.) do not produce considerable heterosis effects. The characteristic of most Sudan-grass varieties is, however, a dominant inheritance, therefore F_1 of sweet *Sorghum* × Sudan grass hybrids is of the Sudan-grass type. By utilization of pollen sterility, this phenomenon may be exploited for the practice. (The initial pollen steril *Sorghum* strain was received from J. C. STEPHENS and J. R. QUINBY, research workers in Texas, in 1955.) Biotypes of very different combining ability were isolated from the Piper variety of Sudan grass. In order to be able to perform biotype analysis and selection of parent strains with a nearer approximation, investigations were instituted with a view to finding more important yield-forming factors for the silage *Sorghum*. Correlations between several factors and the yield were determined and the following values obtained:

Initial development	$r_{0.1}$ per cent = 0.745
Between the weight of 25-day-old seedlings and 150-day-old plants	$r = 0.610$
Density rate	$r_{0.1}$ per cent = −0.616
Tillering	$r_{0.1}$ per cent = 0.556
Plant-height	$r_{0.1}$ per cent = 0.342
Bacterial leaf disease 7a (*Pseudomonas syringae* [?])	$r = 0.361$
Bacterial leaf disease 7b (*Pseudomonas andropagoni*[?])	$r_{1.0}$ per cent = −0.118
Time of maturing	$r = -0.198$

Initial development is, therefore, the most important yield-forming character. Correlation exists already between the weight of 25-day-old seedlings and that of the mature plants. Density rate is naturally of importance, since yields will be reduced when many bare spots are present. Nearly all the well yielding hybrids were of medium maturing but — when the hybrids were examined separately — it appeared that a hybrid is of good productivity pro-

vided it ripens at a later date than its parents. Plant-height and disease-resistance did not play a particularly essential part in yield-formation. A result of practical value is the fact that in 1957, 1958 and 1959 the hybrids produced 30.1, 55.2 and 67.2 per cent more green matter than the varieties, the quality having been the same in all cases.

EFFECT OF X RAYS ON THE X_1 AND X_2 GENERATIONS OF CORN

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Zea × *Euchlaena* hybrids, several 2 to 3-year-old inbreds, strains of the Hungarian hybrid MV5 (C5, 014, 156, 118b), a number of varieties and a material that had earlier been treated with heat shock were exposed to X rays of 10 000 and 15 000 *r* in the year 1958. The nuclei X_1 and X_2 were chemically tested for gross protein content and the amount of protein yielded by the X_2 substrains per unit of area established. It was possible to produce a basic breeding stock which showed a broader range of variations in respect of both gross protein contents and protein yield. Characteristic differences were found in this respect between the plant groups used in the radiation experiments. Sensitivity to radiation proved to be likewise different: most resistant was the previous heat-treated material and most sensitive were the MV5 strains, of a high combining ability. We studied our material also in regard to the size of the pollen grains and the degree of their viability. The substrains were significantly different, a phenomenon pointing to a partial male sterility. Germination tests performed on the substrains in the laboratory under exposure to low temperature proved that the stock is suitable for the breeding of cold-resistant corn varieties. In continuing our experiments with the irradiation of types deriving from mutation treatment, we want to select our material for breeding from three points of view: improvement of chemical composition; production of a type resistant to cold; production of forms exhibiting pollen sterility. Resistance to *Pyrausta nubilalis* may also be increased by producing changes in the tissue elements tending to render cell walls more ligneous.

INCORPORATION OF CO_2 IN GENETICALLY ALBINO AND NORMAL CORN LEAVES

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The inherited albinism of plants is mainly due to the extreme lability of their assimilatory pigments. Pigments are produced in the dark by albino plants as well, these pigments are, however, photolabile which leads to the bleaching of the leaf tissues. In the present study normal and albino individuals, obtained by inbreeding of heterozygous albino corn plants, were compared from the point of view of their ability to synthesize and to assimilate. Seeds were germinated in the dark, and the seedlings were exposed to illumination in an atmosphere of $C^{14}O_2$. It was found that albino seedlings were also able to incorporate CO_2 and that the optimal light intensity for the process was fairly low. The photosyntetic rate of albino tissues at low light-intensities is higher than that of normal plants. Simultaneously also pigment synthesis is going on at a high rate. However, if light intensity rises above a critical level (which is not deleterious to normal plants), the pigments start to decompose in albino tissues because synthesis is overbalanced by their breakdown.

STUDY OF T. AESTIVO-TIMOPHEEVI AMPHIDIPLOID F_2 AND ITS LATER GENERATIONS

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The amphidiploid was produced by treating the F_1 hybrid of the species *T. aestivum* ($2n = 42$) and *T. timopheevi* ($2n = 28$) with a 0.02% colchicin solution.

A morphological examination showed that a large percentage of the intermediary offspring in F_1 retained its transitional nature both in F_2 and in later generations. However, certain splittings became evident in F_2 already where also squarehead, compact and speltoid types appeared which were completely different both from the intermediaries and the two parents. We examined the average (x), the distribution and the deviation from the standard of the value-determining characteristics of the split types appearing in F_2. According to our observations, in F_2 the intermediary and squarehead types had the greatest wheat-ear (x 3.52 or x 3.45) and ear-grain (x 0.20 or x 0.16) values. The compact type and the type closest to the *T. aestivum* parent showed the lowest mean value of the above-mentioned yield components.

We noted an average of about 35—40% of virile pollen in the various offspring of the *T. aestivo-timopheevi* amphidiploid when testing pollen fertility. Cytological examinations revealed also $2n = 56$ chromosomatic monoploids among the $2n = 70$ chromosomatic amphidiploids. Reduction division of the amphidiploid was irregular even in F_4, which is proved by the great frequency of univalents (96.3%). Pairing-off according to the open type of chromosomes was found to be frequent. We saw at both poles a small number of rings, chromatin bridges and the irregular distribution of chromosomes.

DIFFERENCES IN RECIPROCAL HYBRIDS OF DROSOPHILA MELANOGASTER OF FRACTIONS OF PHOSPHORUS TRANSMITTED VIA THE GERM CELLS

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After rearing male and female flies on culture media containing P^{32}, reciprocal crossings were made between the individuals of the "Algeria" strain of *Drosophila melanogaster*. Reciprocal hybrids were compared at a larval age of 4 days. Also larvae grown on media with P^{32} which were the offspring of parents that had been reared on media devoid of the isotope, were subjected to experiments. In addition to those due to sex and age, also differences were discovered which depended on the "way" of incorporation, *i. e.* whether P^{32} was transmitted via the male or female gamets, or was consumed diectly by the larvae. Direct feeding of the larvae with food containing P^{32}, or transmission of P^{32} via the egg cells results in the incorporation of radioactivity in RNA and the acid-soluble fraction. Transmission via the male gamete leads to incorporation mainly into the protein and RNA fractions. By far the highest labelling of the acid-labile phosphorus-groups takes place in the case of transmission via the egg cells. Both kinds of germ cells transmit approximately the same amount of labelled phosphorus into the DNA fraction. The phosphorus metabolism of females cultured on media containing P^{32} and the effect of this cultivation on the phosphorus fractions of their eggs layed between the 1st and the 5th day were likewise studied. Results were expressed as per cents of the phosphorus fractions of virgins. It was clearly shown that the level of DNA, lipoid and alcohol-soluble phosphorus remains unchanged in the fertilized female at the time of ovulation, while the level of protein phosphorus strongly decreases. The analysis of eggs, layed daily led to the conclusion that the protein phosphorus of the mother is directly transmitted to the egg cells, whereas the DNA is steadily synthetized in the mother organism from compounds of a higher turnover rate. It follows that the dynamic constancy of DNA in the mother serves to secure the stability of the organism's metabolism at the time of germ-cell development. — Fractionation of the phosphorus compounds was accomplished with the Schmidt—Tannhauser procedure. To separate orthophosphates from organic esters, the Berenblum—Chain method was employed.

BIOLOGICAL AND GENETIC OBSERVATION OF TRANSPLANTED RABBITS

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Zygotes derived from the crossing of albino Angora ♀ and Vienna blue ♂ were transplanted into albino Angora mothers. A gonadotropic substance (5IU) and prostigmine (50γ) were used for the identification of the sexual cycle and to induce superovulation. This was followed, after 18 hours, by mating, and 22 hours later by the removal of the zygotes from the donors with 1.5 ml of physiological saline heated to body temperature. Immediately after this, the zygotes were transferred into the infundibulum tubae of the recipient animal with an open abdominal cavity. After the normal period of pregnancy 3 offsprings were born. Their sexual distribution was: Nos. 10 and 11 ♀, No. 12 ♂. No. 10 resembled the stature and followed the growth rate of the Angora variety, while Nos. 11 and 12 were similar to the Vienna blue type. No differences could be observed in regard to erythrocyte count and hemoglobin content. As regards prolificacy, backcrossing with Vienna-blue male resulted in vegetative heterosis. Fur was of the opossum type on No. 11 and of the long Angora type on No. 10 which sloughed off subsequently so that the adult animals were short-furred. Animal No. 12 had short fur since birth. The iris of the eyes was pigmented throughout the progeny. Pigmentation of the fur is always black in the normal F_1 generation, but was agouti in the case of the transplanted offspring Nos. 10 and 11 and Vienna blue in the case of No. 12. These colourations and changes in furring cannot be explained by the laws of the Mendelian genetics. Besides the phenotypes of the generation F_1 are not in conformity with the Mendelian law of uniformity. Relying on the evidence of the transplantation experiments and on the observation of the generation derived from the backcross with the parent types, the author concludes that, in respect of colour, red eyed albinos need not necessarily be regarded as homozygotes.

OVARIUM HETEROTRANSPLANTATION TO INDUCE VEGETATIVE HYBRIDIZATION IN PIGS

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Ovarium transplantation with the intention of inducing vegetative changes has thus far been performed exclusively in rabbits.

The author, co-operating with L. Prohászka, performed ovarium transplantation in pigs in 1951. The ovaries of the three middle white donor sows were transplanted into three ovarectomized hybrid wild sows. The double operation performed with laparotomy lasted 10 minutes, the extirpated ovaries were transferred into the recipients in body-warm penicillin solution and the transplanted ovaries were fixed in place by cat gut sutures, at the stalk.

The recipient sows showed evidence of ovulation as early as the 35th to 40th day. In one of the transplanted ovaries removed at 58 days, follicles and major corpora lutea were found.

One of the three recipient sows kept together with a hog, copulated at 65 days following the operation, but no conception resulted.

Thus, in all three recipients the heterotransplantation produced and maintained sexual activity lasting several months.

The ovaries from the recipient sows sacrificed 10 months after transplantation were studied histologically. The germinal epithelium was diminished, progressive cystic degeneration and increased luteinization were visible in the sections and microphotograms.

This operation is the first successful ovarium transplantation in pigs published in the literature.

THE ROLE OF THE SKIN IN THE EXTRATHYROIDAL ^{131}I METABOLISM

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In the skin of laboratory albino rats 30 to 40 per cent of the administered ^{131}I accumulates. This results from active concentration, as it is indicated on the one hand by the fact that in such cases the skin: plasma ratio is greater than unity, and, on the other hand, by the decrease in the ^{131}I content of the skin and the reduction of the ratio to less than 1.0 in response to anions (SCN, ClO_4) inhibiting the active radio-iodine concentrating mechanism.

There is a substantial difference between newborn and adult animals. The former show active concentration for about 10 to 14 days following ^{131}I administration, while the phenomenon does not last longer than 24 hours in adult males.

Autoradiographic studies showed the concentration to take place in the lower region of the epidermis; some accumulation occurs in the hair follicles as well.

In further investigations other species were examined from this point of view. It was observed that the skin of the newborn dog, cat, rabbit, chick, adult guinea pig, mouse and frog did not actively concentrate ^{131}I.

The above experiments proved that the concentration of ^{313}I in the skin is a species-specific property of the albino rat, thus, this fact should be taken into consideration with thyroid function tests based on ^{311}I uptake, in which this species is used.

COMPARATIVE STUDIES OF THE ENZYME PRODUCING AND EXCRETORY ACTIVITIES OF THE LIVER IN FOETAL AND ADULT PIGS

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The production of plasma enzymes and plasma proteins are closely interrelated processes in which the liver has apparently an important role to play. About half of the hepatic protein synthesis falls to enzyme production. The pig was selected as the test object, in which the macromolecular enzymes in the foetal blood are certainly of foetal origin, as a result of the isolating action of the epitheliochorial placenta. There is published evidence to show that pig foetuses have low plasma protein levels. The aim of the investigations was to determine the activity of the foetal plasma enzymes belonging to the different groups and to compare these values with those for adult pigs.

The enzymes studied belong to two groups: *Enzymes produced by the liver cells* (esterases). The manometrically measured foetal plasma cholinesterase activity is half of the adult level. The high value for the foetal total cholesterol/cholesterol ester ratio is an indirect proof of the reduced cholesterol esterase activity. Of the *extrahepatically produced enzymes* the alkaline phosphatase has a much higher level in the foetal plasma than in the adult plasma. This may be explained by the assumption that the foetal liver has a restricted excretory activity, disproportionate to the rate of enzyme production. On the other hand, the low level of amylase in the foetal plasma cannot be correlated with liver function and seems to be rather in connexion with the low-grade exocrine function of the foetal pancreas.

These data indicate that the foetal liver appears to have a restricted enzyme-producing and excretory activity. At the same time the foetal liver weighs about twice as much as the adult one, as expressed in percentage of the body weight. This is explained by the hemopoietic function of the liver in foetal age.

TOPOGRAPHICAL RELATIONS OF RETINAL DEFECTS TO THE OPTICO-VEGETATIVE FUNCTION

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It was earlier demonstrated by the authors that light, when reaching the eyes, induces a prompt, regular eosinopenia by activating the hypophysis-adrenal system. To obtain this normal eosinopenic response, the integrity of some parts of the retina is indispensable. In degeneratio pigmentosa retinae, where the periphery is largely damaged but the centrum unimpaired, normal eosinopenic response is found even if the visual field is reduced to 5°. On the other hand, in degeneratio maculae luteae, characterized by intact vision in the periphery and by central scotomas, even slight changes counteract the fall of the eosinophils. In some cases even minute defects in the centrum — detectable only by testing with blue colour — may prohibit eosinopenia.

These observations lead to the conclusion that a relatively small area of the retina, that is, the macula lutea or a part of it, is responsible for light-induced vegetative responses. The cones of the macula are thus demonstrated as being in man the starting point of the pathway through which vegetative impulses are conveyed. The same is suggested to apply to animals living in daylight and possessing central vision.

CONTRIBUTIONS TO THE COMPARATIVE PHYSIOLOGY OF SMOOTH MUSCULATURE

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Abstract not received.

INTERRELATION BETWEEN THE MODE OF MUSCULAR ACTIVITY AND THE CONSUMPTION OF PERGENS

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According to an earlier communication of the present authors, directly or indirectly stimulated skeletal muscles consume at first almost exclusively KrP, while the breakdown of ATP starts only a few seconds afterwards. The extent of the decomposition of these macroerg phosphates (or — using the suggested term — "pergens") at a given time depends on tension and, in the second place, on the amount of work performed. It is now demonstrated that a considerable amount of pergens is consumed also by slow muscular contractures; this consumption is, however, of a different nature: it is not in direct proportion to either the tension or the amount of work performed. The pergen-consuming action of certain contracture-producing agents is counteracted by their paralyzers (*e. g.* that of alkali by lack of calcium, that of acetylcholine by atropine), while certain substances (*e. g.* potassium) are able to decompose pergens even where and when they fail to produce contracture. Degree of contracture and decomposition of pergens are, therefore, separate categories and vary from agent to agent. This is a further proof of the fact that the chemism of tetanus and contractures are fundamentally different.

The authors announce to have succeeded in settling an old problem of muscle chemistry by demonstrating that protein phosphates are produced during contraction. This has been assumed by several earlier workers, and the present authors have elaborated a precise method to prove it. Fixation by means of deep freezing is followed by denaturation with alcohol — chloroform and then extraction by means of mildly alkaline diluted alcohol (on account of the bond's acid lability). While the amount of P-protein is very low in a state of rest, it multiplies

manifold even during a short term of tetanus. It arises also during contractures, e. g. under the influence of K or H_3N, in amounts of about 50 γ P/g of muscle, (a surplus excedding 100 per cent). It is not observable in lactic acid contractures. Further investigations are in progress.

THE EFFECT OF SH-INHIBITORS ON THE PERIODIC ACTIVITY OF THE FRESH-WATER MUSSEL (ANODONTA CYGNEA)

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Continuing his studies on the periodic activity of *Anodonta cygnea*, the author tried to influence its control mechanism by means of SH-inhibitors.

It has been found that the SH-inhibitors ($CdCl_2$ and p-chloromercuribenzoate) used in concentrations of $1 \cdot 10^{-6}$ g/ml and higher caused a characteristic change in the slow rhythm of periodic activity: the lasting activity (that longer than 20 hours in duration) was replaced by a regular periodic alternation of active and resting phases, 2 to 3 hours in duration. The state of lasting activity may be restored by the administration of cysteine containing active SH groups.

The author has investigated the location of the SH groups the blocking or restoration of which is involved in the control of periodic activity. It has been shown that the stoppage of circulation, which interferes with the flow of substances from the surrounding water into the various organs (nervous system, adductor muscles) has no influence on the action of SH-inhibitors. Pretreatment with cocaine (0.01 per cent) prevents the SH-inhibitors of usual concentration ($1 \cdot 10^{-5}$ g/ml) from exerting their action on periodic activity. After cutting the syphon nerves the SH-inhibitors do not influence the slow rhythm or the previously induced changes in activity cease, while as applied directly to the syphon area of the cuticle the SH-inhibitors produce the characteristic changes in rhythm.

These results indicate that the slow rhythm of the periodic activity of *Anodonta cygnea* may be characteristically altered by the use of SH-inhibitors and that the SH-inhibitors exert their action through a reflex mechanism. The author concludes that the change in the slow rhythm is an adaptive reaction of the animal, with the oxidative metabolism of the cuticular receptors being mainly involved.

HISTOPHYSIOLOGICAL DIURNAL RHYTHM STUDIES ON THE VEGETATIVE GANGLION CELLS OF THE RETINA OF ALBINO RATS

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In male albino rats, maintained at constant temperature and under standardized conditions of illumination, the vegetative ganglion cells of the retina show well-defined diurnal rhythmic changes in structure.

Vegetative ganglion cells from animals killed at noon contain at the periphery of the cells granules varying in size and staining with chromehematoxylin. Besides, at this time of the day cells characterized by very thin cytoplasm are frequent and even naked nuclei, presumably in the phase of restitution, are found.

In the animals killed between 17 and 18 p. m. the vegetative cells are less granulated. Among the granules, many little round vacuoles appear which seem to be optically empty.

* Investigations were carried out at Moscow State Lomonosov University, Chair of Animal Physiology.

The cytoplasm of the vegetative ganglion cells in the animals killed at midnight is foamy, and phloxinophilic droplets varying in size are frequently visible near the nucleus. The content of the vacuoles observed earlier in the day is presumably staining in these cells with phloxine.

The vegetative ganglion cells of the animals killed in the morning contain tiny phloxinophilic droplets at the periphery of the cytoplasm, and among these appear very small granules staining with chromehematoxylin.

The diurnal rhythmic changes observed in the structure of the vegetative ganglion cells of the retina of albino rats resemble conspicuously those structural changes which were earlier described by the author in the supraoptic and paraventricular nuclei of albino mice.

Author attributes great significance to the diurnal rhythmic structural changes studied in the above-mentioned ganglion cells of the retina, and believes that these observations affirm the hypothesis of BECHER who regards the retina as the door of the "heliotropes Bewirkungssystem".

DIURNAL RHYTHMIC CHANGES OF ELECTROLYTES IN THE BLOOD SERUM OF WHITE RATS

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Last year we presented a report according to which the diuresis and the amount of constituents in the urine of white rats show a regularly recurring diurnal fluctuation under certain conditions. Subsequently, our investigations were focussed on the detection of the direct factor responsible for the fluctuation in the excretion of urine. Therefore, an examination of the constituents of the blood serum seemed to be indicated.

Water and dry material content, further the concentration of Na^+, K^+, Cl^- and PO_4^{---} in the sera of white rats were determined four times a day, *i. e.* at 6, 12, 18 and 24 hours. The animals were kept under standard conditions, fed at 6 p. m., and kept in darkness from 6 p. m. to 6 a. m.

Our observations revealed a diurnal fluctuation of the serum constituents. The water content of the serum tends towards a maximum at night; accordingly, the dry-material content reaches its minimum simultaneously. The concentration of the electrolytes in toto is likewise lowest at midnight and highest between noon and 6 p. m. The fluctuation of several electrolytes is not quite the same, their concentration being subject to the smallest diurnal variation, while that of PO_4^{---} is subject to the largest. No antagonism could be observed regarding changes of Na^+ and K^+.

The rate of maximum change in the diurnal fluctuation varies from 5 to 10 per cent in the case of the examined compounds. Though the rate of fluctuation has to be taken into consideration when determining the electrolytes, we do not think that this change alone should be made responsible for the diurnal fluctuations of the diuresis and on the quantitative composition of the urine. Also other changes (plasma volume, blood pressure, diurnal changes of the ADH secretion, etc.) play probably an important part in this phenomenon.

THE EFFECT OF DIETS OF DIFFERENT PROTEIN CONTENT ON THE SEXUAL FUNCTION OF WHITE RATS

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The effect of diets with different protein content on the function of genital organs of female Wistar rats was investigated. Four kinds of diets were fed to different groups of test animals. To rats of group I a diet containing 36% digestible protein (70% of which was of

animal origin) was fed, while those of group II (controls) received the normal diet containing 18% protein (40% of which was of animal origin). Group III received only 6% protein (exclusively of plant origin), and group IV was fed a semisynthetic diet completely devoid of protein. All these diets were isocaloric.

The sexual function of the tests was controlled by the microscopical investigation of samples scraped off the vaginal epithelium every day; after having sacrificed them, we subjected their ovaries and uterus to histological examination. Diet very rich in protein (group I) had no harmful effect on the sexual function of the animals during the 70 days of the experiment. Histological investigations revealed a normal vaginal cycle. Control animals of group II showed, of course, a normal condition not only in respect of the vaginal cycle but also concerning histological properties of the ovary and uterus. The vaginal cycle of animals, fed a diet poor in protein (group III) for 70 days, proved likewise normal but a histological examination of the ovaries and uterus of these animals revealed changes (degenerated ova, slightly atrophic uterus) which excluded the possibility of conception. Animals fed a diet devoid of protein (group IV) discontinued all sexual functions already after 10 to 12 days. Histological investigation showed a complete atrophy of their inner sexual organs. Earlier diets were found to have no influence on sexual function, as animals that had been fed 36, 18 and 6% digestible protein, respectively, reached the period of anoestrus likewise 10 to 12 days after starting a protein-free diet.

On the 12th day of anoestrus or the 25th day after starting the protein-free diet oestrus could be produced in 2 to 3 days by the injection of chorion-gonadotropic hormone preparations. This state lasts, however, only a short time after which anoestrus sets in again.

When protein-free diet was replaced after 25 days by one of normal protein content sexual functions revived in 10 to 12 days. In the pathogenesis of "lager amenorrhea", beside effects due to the nervous system, also the role of chronic protein deficiency is emphasized.

PROPERDIN LEVEL IN DIFFERENT RACES OF RATS

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Authors have earlier published the results of investigations in which they compared the complement titre and bactericidal power of sera belonging to rats of different races (wild, laboratory white, and Wistar). They pointed out that sera of wild rats contained the greatest and those of laboratory white strain the smallest amount of these factors of natural immunity. Authors supposed that these results might be in connection with different properdin levels in these animals.

A recent examination of the properdin level of these different strains showed that sera of wild rats contained 30.5 to 40.0 U/ml of properdin (average: 36.65 U), while those of laboratory white strains 15.0 to 24.0 U/ml (average: 18.35 U). Rats descended from the inbred stock of the Wistar laboratory showed intermediate values of 22.0 to 33.0 U/ml (average: 28.4 U).

These values are in accordance with those of complement titre and bactericidal activity of blood sera, and justify the assumption that both properdin level and other factors of natural immunity are governed by common humoural and neurogenic processes. These results also suggest that the properdin level and the degree of natural immunity are properties which — as has been formerly pointed out — could be modified by some external factors which have changed during the domestication of laboratory rats.

NEW CONTRIBUTIONS TO THE ROLE OF PARATHYROID IN PROTEIN METABOLISM

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