ACTA BIOLOGICA

ACADEMIAE SCIENTIARUM HUNGARICAE

SUPPLEMENTUM 5
(SUPPLEMENTUM AD TOMUM XIII)

PROCEEDINGS OF THE FIFTH MEETING OF THE HUNGARIAN BIOLOGICAL SOCIETY

Budapest, May 24–26, 1962

AKADÉMIAI KIADÓ, BUDAPEST
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THE RHYTHM OF LIFE

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Biologists have been concerned for several decades with the adaptation of plants and animals to the spatial conditions of the environment. Adaptation to the chronological order of the environment has only recently become a subject of study and analysis. Adaptation to the chronological order of the environment includes a number of life processes that can be observed in all living beings; these processes are not continuous but periodical and alternate according to a certain rhythm. They mean an adaptation of the living being to the diurnal and seasonal changes of environment; it is, therefore, justified to term this periodicity as "rhythm of life". This periodicity is present in all the life processes of plants and animals; it applies also to the activities of the human organism which, however, is influenced by social factors as well.

Not so long ago many students of biology still felt out of place when confronted with the rhythm of life, although there is hardly any life process or activity that could be regarded as continuous. In spite of this, as lately as in the last decades biologists still assumed that the various organs of the animals functioned as machines. FORSGREN was the first to recognize the rhythmical functioning of the liver, although we think that a knowledge of rhythmical processes was not fundamentally new. On the contrary, it rather seems that there was hardly any research worker who would not have guessed these relationships. Many quotations and evidences can be cited in support of this view. Let us name HUFELAND who in his well-known work, published as far back as 1797, referred to the 24-hour periodicity in man.

Many notions are used in this new domain of research that need to be defined since, as stated by KLEITMANN, difficulties arising from the coordination of different views concerning the origin and survival of periodical phenomena are mostly due to a confusion of terms. To designate the regularly recurring alternations in the changes of life processes, the various authors use such terms as periodicity, rhythm, cycle, fluctuation, oscillation, variation, etc. Rhythm means the occurrence of similar changes at similar intervals but it may be also understood as a regularly recurring alternation which manifests itself through a movement, a process, a change or a phenomenon. According to other authors, rhythm either means the regularly recurring quantitative changes effecting periodicity or the measurable manifestation of these processes (HALBERG). At any rate, the phenomenon should be termed rhythm as contrasted to the stroke of machines; it is a feature of living beings, an ancient phenomenon of life (JORES) which appears in the course of phylogeny in an ever more intricate form in the passing of life processes in time.

The attribute "24 hour" is employed to indicate periodical processes and structural changes which take about 24 hours. The attribute "diurnal" also serves to indicate 24-hour changes, with the limitation, however, that the changes occur in subsequent sections of the same day. Under the term seasonal rhythm the structural and functional changes occurring in the four seasons of the tropic year: spring, summer, autumn and winter are summarized. It should be taken into consideration, however, that the four seasons can be thus distinguished only under medium geographical latitudes *i. e.* in the temperate zone, since quantitative and qualitative changes in the environmental factors are different in the torrid and arctic zones. In connection with definitions the term periodicity deserves special attention; it indicates all regularly recurring changes, whether in the living or the inanimate nature, irrespective of the time period of the periodical changes and of the mechanism manifesting itself in the change, so that the expression tells nothing of the intrinsic factors involved in the phenomenon. Again, the term cycle is understood as the totality of changes recurring within the organism in an integrated form as a result of certain definite mechanisms with discernible time periods. Synchronizers, so significant in rhythmic processes, mean environmental factors or those phenomena of the environment which are perceived as stimuli by the organism, and determine

the chronological situation of a given rhythm within the 24-hour or seasonal period. In this case intermittent or continuous phenomena may be involved, or a regularly recurrent transition of a state into another, such as the alternation of light and darkness.

As regards the 24-hour rhythm, the information about the course of the day is very important for the animals, many of which are in possession of the so-called "sense of time". For instance, bees can be accustomed to search food at a certain time of the day. After having received food for several days at the same hour, they will start for the food even if it is no longer given to them (RENNER). It is not clear how insects perceive differences in time. It is in any case doubtless that bees, regularly fed at a certain hour, somehow "learn" when to expect nourishment. This phenomenon has already been demonstrated by the Pavlovian school on mammals, and it may be interpreted in the sense that time has become the conditional stimulus of food. The "sense of time" is undoubtedly based on periodical chemical processes occurring in the organism. The correctness of this view was then verified by experiments in which the metabolism of bees, so trained, was promoted by a treatment with thyroglobulin. As a result of this treatment, the bees appeared for the food before the usual time, whereas the opposite result was obtained by the administration of quinine (GRABENSBERGER). It follows that the "sense of time" depends — at least in Arthropoda — on periodical metabolic changes of the organism.

An interesting way to perceive the passage of the day has been recognized by the study of photoperiodical responses. It was observed that — like in the vegetable kingdom — certain changes in the physiological processes were controlled by the length of the day. So among others the seasonal rhythm of propagation, the onset of the rest period or dormancy, *e.g.* the diapause of insects, are determined by the length of day rather than by the amount of light. This is supported by the observation that photoperiodical responses can be brought about invariably by the prolongation of the daylight by a very weak artificial light. In these cases it is not the intensity but the duration of the photic effect which is the decisive factor. This photoperiodism has a great importance not only in plant physiology but also in zoo-biology because the "critical day-length" affects the passing of animals into the period of rest, further its termination as well as the swelling and detumescence of the sexual glands of birds and other animals. That not the intensity and the amount of light are involved in these phenomena but the length of day is evident from the fact that these time-measuring processes induce equal photoperiodical responses in daylight and moonlight alike. Moreover, animals use this most reliable criterion of the environment for gaining information about the passage of seasons and are thus able to adapt their life processes to the change of seasons. The seasonal fluctuations of temperature or light quantity do not supply as reliable information as the length of day because a certain daily mean temperature and even a weekly mean temperature may recur several times a year, while a certain definite day length occurs only once in spring and once in autumn at the equinox. Even at the two equinoxes it is only the length of day time which is equal, whereas — in Central Europe — the quality of sunlight is as a rule spectrally different, a fact which substantially influences the periodicity of life processes.

This chronological orientation, based on the strength of the seasonal changes in day-length, may be explained by the assumption that animate creatures have acquired during phylogeny a hereditarily fixed sense of time. It is with the measure given by this sense, or possibly with the day-lengths, that the organisms compare day by day the length of darkness or light. As soon as in autumn and spring, days become shorter or longer than the inherited measure, a physiological alarm signal releases a whole series of processes. Of course, man, too, has a physiological time measuring capacity that developed in the course of phylogeny and, on the other hand, as an effect of the factors of social environment.

The measurement of daily time takes place according to an identical biological principle, the periodical processes constituting the principle of physiological time measurement. If, for example, bees "trained" for a certain part of the day cannot go in quest of food for a few days, say, on account of bad weather, later they will still "know", when to look for food; they again visit the feeding place at the accustomed time (WAHL). Hence, the "biologic clock" operates with the so-called periods of diurnal rhythm.

This diurnal rhythm does not manifest itself only through the "sense of time" of bees but also through a number of other physiological processes such as diurnal pigment migrations or the fluctuation of kinetic activities. The latter have been examined mainly in insects and mammals; for example, investigations concerning spontaneous activity were performed on white and wharf rats in this Institute. In white rats, a definite 24-hour rhythm of the spontaneous activity was demonstrated: a very pronounced motor activity was observed as from 6 p. m. which lasted through the greatest part of the dark period and was followed by a rest period lasting until 6 o'clock in the morning. About this time, which coincided with the switching on of light, a second but shorter phase of activity began. Then an uninterrupted period of

rest ensued until 5 to 6 p. m. According to the actograms, the overwhelming part of the motor activity (77 per cent) occurred in the 12-hour dark period. According to comparative investigations concerning spontaneous activity, white rats — kept in a certain season, and under certain environmental conditions — have a polyphase, and wharf rats a monophase, activity. The periodical alternation of light and darkness decisively influences activity and manifests itself more strongly in the wharf than in the white rat. Activity is further somewhat affected by the time of feeding but this influence is weaker in the wharf rat (KURCZ). In other experiments, the emergence of insects from the pupae was examined from the angle of diurnal rhythm. In addition, quantitative changes in metabolism, carbon dioxyde production or oxygen consumption under constant conditions have been demonstrated (RALPH, WOLF, BROWN).

Rhythmic processes in living beings are under cellular and central control. It is noteworthy that cellular regulation is limited to plants, mainly to unicells, while the majority of zoologists agree that there is a central humoral and hormonal regulation in the animal organism. This has been experimentally demonstrated. Humoral control is evidenced by the behaviour of some blood parasites; there occurs, for example, a prompt phase-shift in the developmental periodicity of *Plasmodium cathemerium* if the host organism is exposed to the light and darkness of inverted periodicity (BOYD). The periodicity of *Microfilaria nocturna*, a parasite of human blood, is also regulated by the periodical change in the chemical composition of the plasma, since, when the usual chronology of human life is reversed, the developmental rhythm of these parasites changes accordingly (YORKE and BLALOCK). In all these cases the alternation of light and darkness brings about periodical changes in the host organism which influences the composition of the blood.

Another type of central regulation is found in Arthropoda; fluctuations of pigment are, according to certain authors, controlled by periodical processes in the nervous system (DEMOLL). In Crustaceans, attention has been called to the significance of the eyes in the regulating mechanism operated by the alternation of light and darkness; besides, importance is attributed to the blood in the transmission of impulses (WELSH). KOLLER pointed to the intermediary role of hormones in Crustaceans, while KLEINHOLZ caused pigments to migrate by means of eye-stalk extract. Earlier investigations were unsuccessful in this domain but more recent research work has found a better approach to the question of central regulation. HARKER demonstrated on the *Periplaneta americana* that the rhythm discontinued after decapitation, but reappeared when a homologous subpharyngeal ganglion was implanted to the decapitated individual. It results also from other investigations that periodical activities in the Arthropoda are subject to central hormonal regulation. Neurosecretory cells in the cerebral ganglion of the *Carabus* have been shown to operate according to a diurnal rhythm. It is, however, still uncertain whether the rhythm of the neurosecretory cells originates from the cells themselves or whether it is centrally regulated as it is in vertebrates.

The theory regarding central regulation of the diurnal rhythm in vertebrates is substantiated by the synchronous occurrence of several diurnal activities. It is further supported by certain workers according to whom the control of diurnal activities is located in the central nervous system which operates by adequately influencing the endocrine glands (ASCHOFF).

Already YOUNG, and later JORES, pointed to the regulatory significance of the hypophysis; since then, numerous workers have concerned themselves with investigations concerning endocrine activities and structural changes in the animal organism. Other investigations bore on the problem of regulation, among others the relationship between the diurnal rhythm of the eosinophils and the rhythm in the adrenocortical secretion of ketosteroids (HALBERG, RADNÓT).

The relationship between the 24-hour processes and phenomena of the organism and the likewise diurnal rhythm of the endocrine glands has been investigated in this Institute. Besides investigating the thyroid, adenohypophysis, adrenal, and the interstitial testicular cells of white mice, their spontaneous activity and oxygen consumption were also studied; apart from finding rhythmical diurnal changes it was observed that the maximum of structural and functional activities occurred in darkness, a phenomenon in harmony with the nocturnal habit of these animals.

It has been found that the thyroid of white mice is least active in the morning, somewhat more active at noon, most active in the evening, and that activity decreases once more at midnight (MÖDLINGER).

As regards the number of acidophils in the anterior pituitary, it was found to be highest in the evening, less during night, minimum in the morning and once more increasing towards midday. Two types of basophil cells occur in the examined animals. Small globular basophil cells in which the cytoplasm contains PAS-positive and AF-positive granules are scarce. They are reduced to a minimum at noon, their number increases in the evening, reaches a maximum at night and diminishes again in the morning. The other type of basophil cells containing PAS-

positive and AF-negative granules exhibit two maxima, one in the evening and one in the morning, further two minima, one at midnight and one at noon (ODORFER). A histochemical analysis of the adrenal cortex shows that it contains the highest amount of lipids in the evening and the lowest in the morning. Storage of birefringent lipids begins early in the morning, increases about the middle of the day, reaches a maximum in the evening and diminishes again considerably at midnight. The volume of the nuclei of the fasciculate zone shows likewise a 24-hour cycle: the largest nuclei were observed at midnight, and the smallest at noon. The dark adrenaline-producing and the light noradrenaline-producing medullary cells are easily distinguishable in daytime. Because of increased adrenalin production, the distinction between dark and light cells is less clear at night (KONDICS). It has been found that the volume of the nuclei in the interstitial cells of the testicles is likewise subject to a diurnal change: it is greatest at midnight and diminished by 6 a. m.; this level is maintained until midday, to become lower again and reaching its lowest value at 6 p. m. Then a new increase follows, and the maximum is once more reached by midnight (KOVÁCS). Rhythmic structural changes occur also in the neurosecretory cells of the supraoptic and paraventricular nuclei of the hypothalamus: neurosecretion is synthetized at night and mobilized at noon (ODORFER). The oxygen consumption of the animals shows a definite diurnal fluctuation, being low in day-time and high at night (KURCZ).

The thyroid gland of white rats has a rhythm similar to that seen in the white mouse; the thyroid of white rats is, however, generally more active (MÖDLINGER). A similar rhythm has been observed in the anterior pituitary: the secretory activity of the α-cells is highest about noon and in the evening. Since this activity is parallel to that of the thyroid, it may be assumed that the α-cells produce thyroproliferin, one of the thyreotropic hormones (ODORFER). A diurnal rhythm can be observed also in the adrenal cortex in respect of lipids, ascorbic acid, ribonucleic acid and cell mitosis. The diurnal rhythm of the glomerular zone is regulated by the uptake of food, whereas the rhythmic structural changes of the fasciculate and reticular zones are controlled by the alternation of light and darkness (KONDICS). Rhythmic changes depending on the alternation of light and darkness have been observed in the neurosecretory so-called vegetative ganglion cells of the retina (ODORFER). The renal function of the same animals follows a pronounced diurnal rhythm, as reflected by the fluctuation of the urinary output and the quantitative change of its constituents (KURCZ).

The 24-hour rhythm of the endocrine glands is closely related to the periodicity of the sexual cycle and the oviposition. It has been experimentally proved that the sexual activity of rats is highest in darkness, and that this phenomenon is largely regulated by hypophyseal hormones. By birds the laying of eggs is limited to certain hours of the day, and the diurnal rhythm of the hypophysis is of decisive importance also in this instance as has been demonstrated on pigeons in this Institute (APOR and STOHL).

The question arises here whether diurnal rhythm can be modified by a change in the synchronizers, in other words, whether rhythm can be desynchronized. It seems that various diurnally rhythmic activities are not always under uniform regulation in higher animals. This becomes clear when we want to change the rhythm of the organism by an inversion of the sequence of light and darkness: in respect of some activities, a satisfactory result can be obtained in 2 or 3 days, whereas other functions require 8 to 10 days for being adapted to the new rhythm of light and darkness.

The diurnal rhythm of structural and functional changes leads us to seasonal rhythms, and this the more as the various phases of the diurnal rhythm itself may undergo seasonal variations. Different organs, the endocrine glands in particular, have been studied in vertebrates and invertebrates alike.

As to the seasonal changes of the endocrine glands, in the first place the periodical changes, occurring in each season and recurring each year in structure and activity of thyroid were dealt with. It has been found that the thyroid gland of poikilothermal animals displays a lower activity and is more directed towards storage in winter and shows increased activity in summer, whereas the activity of warm-blooded animals is more intensive in winter and is directed towards storage in summer (LIEBER, HAGEN, MEISENHEIMER, EGGERT, WATZKA, SPÖTTEL, GLEBINA, G. GÁL, I. GÁL, MÖDLINGER). Seasonal changes in the structure of the three pituitary lobes have been observed by several authors (SKLOWER, BOCK, MATTHEW, LANGE, SCHILDMACHER, KOCH, APOR). Investigations carried out on guinea pigs and white mice revealed seasonal changes in the interproportion of the three kinds of adenohypophyseal cells (ODORFER). Few workers have concerned themselves with the seasonal rhythm of the adrenal, although it was exactly in this organ of the frog that a seasonal appearance of certain cells was first demonstrated (STILLING). STOHL was the only author to examine seasonal structural changes in the adrenal of guinea pigs, ground squirrels, musk-rats and bats. The three adrenocortical zones and the medulla of guinea pigs were found to show marked seasonal

structural changes. According to observations made in this Institute, the structure of the insular apparatus of pigeons changes with the seasons, their blood-sugar level fluctuating in parallel (ELEKES).

Seasonal structural changes can be observed in the neurosecretion of the nucleus lateralis tuberis of tench, *Tinca vulgaris* (SCHARRER), in the subpharyngeal ganglion of *Paludina* (GORFF), as also in the cerebral ganglion of *Astacus leptodactylus* (KONOK).

The question arises as to the factors causing these changes. Ever since the onset of experimental research work on periodical processes there have existed two opposite opinions. The adaptation of biological periods to the periodical processes of the physico-chemical environment and to the various seasons indicates that external factors are deeply involved in the regulation. When biological rhythm is determined exclusively by such environmental factors we speak of exogenous rhythm. If, in the laboratory, the connections with the periodically changing environment are inhibited and a constant artificial environment is created, animals with a purely exogenous rhythm, *e. g.* ants, become aperiodical, whereas other animals maintain their periodicity also under such conditions. Rhythm in the latter case is rooted in the animals themselves and is termed endogenous. Between these two extremes, the existence of a third may be postulated where a joint manifestation of both rhythms can be observed. This would mean that, under natural conditions, endogenous periodicity is always closely connected with exogenous regulation, since the effect of exogenous factors, a sort of superposed layer, might influence in certain species the phylogenetically evolved endogenous rhythm.

So, when searching for some exogenous factor, we find a great number of periodical processes in the environment, and it is difficult or impossible to pick out one of so many factors as responsible for the rhythmic changes, since complex rather than simple effects are involved. The place of a given rhythm within the diurnal or seasonal period is determined by meteorological factors that might be regarded as meteorological synchronizers. It is as yet unknown by which of the synchronizers life rhythm is influenced and to what extent because — so far — only the effects of few synchronizers, mainly of light and temperature, have been thoroughly examined.

The assumption that the diurnal rhythm is an alternation of chemical processes in the organism, gave the incentive to examine the influence of temperature on the length of the periods. It was to be expected that periods would become shorter at high, and longer at low temperatures. As a matter of fact, the first experiments supported the theory of a dependence on temperature (KALMUS), but the prolonged effect of higher or lower temperatures resulted in the observation that periodicity, with some reservations, was largely independent of temperature. This was demonstrated in the first place in respect of the "sense of time" in bees (KALMUS). Fluctuations of temperature that occur once only, or follow a diurnal periodicity, are, except for insects and amphibians, generally less effective as synchronizers than the alternation of light and darkness.

As regards diurnal and seasonal rhythm the effect of light and darkness as also that of different wave-lenghts have been more thoroughly studied than that of temperature. Experiments performed in this field make it evident that light has a decisive influence on the development of 24-hour and seasonal rhythm.

The gonadal function of birds can be increased with artificial light, and — when in a state of rest — the sexual glands can be activated (ROWEN, BENOIT, BISSONETTE). Contradictory findings of further experiments with light prompted us to investigate the problem: we examined the effect of light rays of different wave-lengths and that of darkness on the thyroid of pigeons. Changes occurring in the structure of the thyroid under the influence of light were found to depend on the wave-length of light, and the structural changes could be reconciled with the seasonal changes of rhythm as observed in pigeons. On the evidence of our experiments, we are in agreement with SCHARRER and think that it is along the line: eye-central nervous system — hypophysis that one has to look for the mechanism of the effect produced by light. The subsequent investigations of FREY concerning the physiology of visual function, those of BECHER concerning the secretory vegetative ganglion cells of the retina, and also the investigations of HOLLWICH concerning the effect of light on metabolism have contributed to the solution of the problem. The relationship between hypothalamus and hypophysis, however, was a subject of controversy even in recent years; on the strength of results obtained so far, a neural and humoral relationship may be assumed. Too, it may be taken as granted that the activity of the adenohypophysis can be increased by hypothalamic stimulation. According to MILIN and ODORFER, light and darkness induce structural changes in the hypothalamus and give rise to a diurnal rhythm in its neurosecretory cells. Morphophysiological research work of this kind has been conducted in this Institute in connection with rodents: it concerned the effect of light and darkness on endocrine organs. Light and its absence has been found to influence the structure and function of endocrine glands.

The parallelism between the diurnal rhythm of neurosecretion, as observed in the vegetative ganglion cells of the retina in rats (ODORFER), and the alternation of light and darkness suggests that we have to regard the eye as the entrance to the "heliotropes Bewirkungssystem" (BECHER) which interferes with the processes of life by way of the vegetative nervous system and the hormones.

Light as synchronizer affects different species in different forms, a fact which goes far in explaining the contradictions encountered in literature. These different effects are due to differences in the mode of life of the examined species of animals. Some of the experimental animals are active during daytime, many at nightfall, and others at night. How far rhythm depends on the mode of life and, according to the natural conditions of life of the species involved, which of the synchronizing effects actually regulates the periodical processes, *e. g.* the 24-hour rhythm, appears from the investigations of SLONYIM et al. They demonstrated that the diurnal rhythm of bats was based on a conditioned reflex; closer examination revealed, however, that in the case of bats, *i. e.* in that of animals living in the dark, the diurnal rhythm could not be changed by a regular change in the photic conditions or in the environmental temperature; uptake of food was found to be the only factor determining the 24-hour rhythm in these animals.

The position is completely different concerning the 24-hour rhythm in monkeys where it is exactly light which constitutes the most important synchronizer. SHTCHERBAKOVA has experimentally demonstrated that the 24-hour rhythm in monkeys can be completely transformed by the arbitrary change of photic conditions. She transformed the natural monophasic 24-hour rhythm of the monkeys' metabolism and activity into a diphasic rhythm by changing the light in the cages of the animals within the space of 24 hours into a diphasically alternating one, *i. e.* by dividing one sidereal day into two daytime periods and two nights. Other workers developed similar conditioned reflexes in poultry, thus forcing the animals to two egg-layings per day. One is dealing in such cases with Pavlovian reflexes conditioned upon time which are of high importance for life-processes occurring under natural conditions.

The question whether investigations concerning life rhythm are significant and promising can be answered in the affirmative not only when considered exclusively as a new trend and view in biological research work but also if we regard them from the angle of medical science and practical life.

RHYTHMIC PHENOMENA IN PLANT LIFE

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The study of any fundamental physiological process in the living plant indicates that biological events are rhythmic at some level due to the periodical reestablishment of biochemical and biophysical equilibria subsequently to reiterated intrinsic contrasts. Synthesis and breakdown of proteins is a cyclic process similarly as in respiration the Szent-Györgyi-Krebs cycle or the Calvin-Benson cycle in photosynthesis. The growth of plants, enlarged or speeded up a millionfold by the use of the crescograph, proved to be the sum of a number of minute pulsating movements. The pulsation is an endogenous, rhythmic process.

The chain of rhythmic growth quanta amalgamates and, when investigated in another dimension of time growth appears to be continuous for a couple of hours. Within a 24-hour growth another rhythm makes its appearance as a result of adaptation to the diurnal changes in environmental factors. This rhythm is obviously exogenous in many cases however, it is maintained for a while even under constant environmental conditions (according to SACHS, BARANETZKY, GODLEWSKI).

Similar observations were made in connection with the nyctinastic foliar movements of some papillionaceous plants. Thus the phases of the movement in *Canavalia ensiformis* might be shifted by illumination applied even if for a short period at an unusual time the 24-hour periodicity persisting in this case. By contrast, in *Albizzia lophanta* even the length of the periods can be changed by altered environmental conditions.

The nyctinastic movement is caused by the change in the turgor of the leaf base. This is conditioned by the water permeability of the cytoplasm which depends on the changes in intracellular pH value and in final result on plant metabolism.

The rhythmic, circulating movement of the leaflets of *Desmodium gyrans* is also remarkable. This movement is endogenous in that its pattern does not follow any rhythmic change in environment. Under the influence of prolonged heat and light stimuli a circulating action current originates at the pulvinus which leads to a metachronic change in turgor pressure, changing the permeability of the labile protoplasmic structure point by point. The process taking a whole turn around the pulvinus returns to its starting point where during the refractory period the equilibrium of protoplasmic structure is reestablished mainly by the use of energy produced during respiration. The process then starts again.

The dormant and active stage of buds also undergoes a rhythmic change, even under constant conditions. This is evidenced by the studies of MAXIMOV on oak seedlings kept in constant illumination and optimum temperature. This periodicity is probably connected with changes in nucleic acid concentration during cell division. The activity of meristematic tissues and the division of nuclei often exhibit a diurnal periodicity. Studies on this problem were carried out among others by KELLICOTT, FRIESNER, KARSTEN, STÅLFELT and FRENYÓ.

The investigation of rhythmic phenomena might lead to a better understanding of the metabolic basis of the relation between plant and environment.

MEDICAL ASPECTS OF PHOTOPERIODISM

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Several cyclic functions of the human organism are known for a long time which are in accordance with circadian (diurnal) rhythm.

From circadian rhythms, blood pressure, pulse rate, intraocular pressure, water excretion and behaviour of blood serum and blood cells show rhythmic changes being definitely independent of sleep.

It is a known fact nowadays that these functions are decisively related to alterations *viz.* absence of light, a fact which has been proved by the following examination methods. (i) Investigation of individuals leading an inverse mode of life; (ii) investigations carried out in blind persons; and (iii) investigation of individuals with a good visus under the effect of light and its deprival, respectively.

JORES had already stated that during sleep, *i. e.* during the night, the blood becomes more watery ("Das Blut wird wässeriger") and the observation that nocturnal discharge of urine is less than the diurnal one, is over 100 years old. According to QUINKE, the explanation for this phenomenon is related to sleep, a statement which, however, had been refuted by SUTER and MEYER as soon as at the same period.

During the last decade, it has become evident from investigations by HOLLWICH, FUCHS and SCHUMANN that no difference between diurnal and nocturnal urine excretion is observed in blinds, *i. e.* blinds are nycturiates. According to clinical observations, blind individuals lose weight subsequently to the healing process due to loss of water. YONEBAYASHI in his recent investigations proved that water content of the blinds' blood is higher than that of normal individuals. The effect of light on the water content of blood can also be demonstrated in normal individuals.

The fluctuation of organic and inorganic constituents of the serum is also a function of light effect. G. FARKAS in 1928 demonstrated that the protein content of blood is lower during the night. The protein content in the evening shifts towards globulin. These investigations have been confirmed by LANG.

The 24-hour fluctuation of red blood cells and white blood corpuscles was a fact known for a long time, no importance has been attached, however, to the change of light.

Mainly since the investigations of BENOIT it became known that when covering the eyes, the effect of light on the gonads fails to come about. An observation that naturally evoked the interest of the ophthalmologists. Since many years part of our research work at the First Department of Ophthalmology in the Medical University is directed to this question.

Taking into consideration the action mechanism by which growth and activity of the gonads is produced by light, it becomes most probable that it exerts also some influence on the adrenals; observations made by JORES as to epinephrine refer also to this fact. Our patient material has made it possible to carry out individual investigations on healthy subjects periodically deprived of light, since for certain operations the patients have to be provided with bandages on both eyes for shorter or longer periods.

In investigating the adrenals, it is the fluctuation of the absolute eosinophil rate since the test of THORN and coworkers which is observed. As to the test itself, it is a much discussed problem, since even in intact adrenal function a pathological function is indicated by it. It is advisable to carry out simultaneously determinations of the ketosteroids, *i. e.* of the corticoids. The test proved to be sufficiently reliable when allowance is made for the fact that light influences the function of the adrenals.

The eosinophil curve of individuals kept in the dark does not fluctuate. In case light gets to the eyes, the initial value decreases to its 60 per cent 2 to 4 hours later. It is known for a long time that the diurnal curve of the eosinophil cells falls under normal conditions in the morning, as also that this fall does not occur in blinds or is at least less than normal. It has, nevertheless, not been taken into consideration that this is a question of light effect. If in the Thorn test the first specimen of blood is taken before light had reached the eye, the result will be according to reality. Eosinopaenia caused by light is of about the same degree as the fall caused by epinephrine. Voidance of the ketosteroids is parallel to the fluctuation of the eosinophils. There is a difference between the night and day fraction even in case the difference between day and night fraction of the total quantity of urine is considered.

At the beginning, we have carried out the investigations in sun light, later on in artificial light and the necessary amonnt of light was determined for a morning eosinopaenic value known as normal. Eosinopaenia can in the course of the day be produced several times by light.

STEPANIK reported that behaviour of the eosinophils and fluctuation of the intraocular pressure show a certain parallelism; he had, however, failed to take into consideration that both are functions of photic effect.

Investigations carried out in different diseases have led us to the recognition that in man it is the central portion of the retina which is essential for the production of vegetative functions. In several instances, because of opacity of the refractory media due to lesions of cornea, lens or vitreous body, there is no possibility to have a look into the eye. Examination methods available are subjective and even electroretinography does not lend any help for localization, so that in such instances it is decided from the eosinophil curve whether the centre is intact or not. In a particular case, in one of our patients with cataract, degeneration of the macula occurred on one eye, and the other could not be examined internally because of the cataract. Only in case of an intact fundus could an intervention be carried out in the old person referred to and the decision depended on the above examination. The post-operative state justified our supposition. In some instances, the lesions of the fundus are only slight and since photography of the visual field is a subjective method, cases occur in which aggravation is surmised. In such instances it is the eosinophil curve, — a finding not influenced by the patient, — that decides the question and lends some help.

In lesions of the macula, central scotoma is present. The origin of central scotoma may, however, be higher up in the nerve path, in the retrobulbar portion of the optic nerve or even higher. It is not always an easy task to differentiate between a lesion of the macula and retrobulbar neuritis. It is again the eosinophil curve which is decisive in this problem.

In evaluating different functional investigations, water and sugar metabolism as well as the rhythmic changes of liver function have to be taken into consideration, as also the state of the eyes, first of all in different investigations carried out in the field of gerontology, since in old age lesions of the retina are often localized in the region of the macula.

It is a well known fact that the examination specimens, if possible, have to be taken at the same time, but also the fact that light had affected the condition of the patient has to be considered.

In the field of clinical medicine, a wide range of animal experiments are indispensable. It is, however, rarely considered that functions in the majority of the experimental animals are the reflections of responses to be observed in man.

Investigations carried out in human physiology and pathology are nevertheless based also in this field on results of biology, the development and results of which enrich the clinical research.

SOME QUESTIONS OF PHYTOCOENOLOGY AND OF PRACTICE

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According to the matter of its investigations, phytocoenology ("phytosociology") shows an extremely complex character, it touches not only many other branches of biological research (other disciplines of geobotany, biocoenology, zoocoenology, soil zoology, limnology, taxonomy, population genetics, palynology, autecology, ecological physiology, bioclimatology) but, in addition to this, it is connected also with other departments of research work utilizing — beyond the domain of biology — several sciences as "auxiliary sciences" (to these belong: geology, geomorphology, climatology, pedology, some disciplines of applied agricultural sciences, *e. g.* forestry, and — last but not least — mathematical statistics).

On the surface of the Earth and in its biosphere, respectively, there is practically not a single species of plants or animals, which would or could exist alone in its lifeless environment. Under more or less natural conditions all plants and animals or species populations are members of a concrete, seizable life community, *i. e.* of a biocoenosis, which unites most different, fairly loose or unbreakably connected forms of symbiosis.

The examination of biocoenoses is the task of synbiology, the attitude of which differs essentially from that of the idiobiological branches of biology. A biocoenosis means not simply the sum of the plant and animal species a + b + c + . . . + n, but is a qualitatively new, objectively existing reality in which every member of the biocoenosis may exert its functions and organic substance production only in interaction with the functions and production of the other members as well as with the site, according to the specific regularities of synbiology and on the basis of internal harmony or contradiction.

Although biocoenosis has a structure, function dynamics and — to a certain degree — an autoregulating feature, it is theoretically and ideologically quite wrong to compare it with a living organism as it is done even today in western countries.

A living organism, although being intimately connected with its environment too, is nevertheless a closed system; in the case of the fauna a single being can usually be separated but in the flora the limits of an individual are often indistinct (unrestricted growth, different forms of vegetative propagation). Biocoenoses, on the contrary, are open systems and although organized to a certain degree (of course on an other level) they cannot be detached from their environment, the site.

Because in general biocoenoses show an extremely complex composition in which — due to several causes — many plant and animal species standing on very different levels of phylogeny and organization are united to one life community in different ways, their examination comes up even methodologically against many barriers. Biocoenology is a science still in evolution, it was established and may develop necessarily for the moment as a discipline investigating only a part of biocoenoses. In the composition of terrestrial biocoenoses the flora plays the dominant role not merely by its mass but also by its functions and production (photosynthesis), therefore phytocoenology is the most developed branch of biocoenology. Similarly, researches on the hydrobiocoenoses as half-closed systems, on the life communities of lakes, made a progress in limnology. Due to the considerably higher number of animal species and many methodological difficulties deriving from the nature of animal life, terrestrial zoocoenology began to develop rapidly in the last decade only.

In all cases the specific regularities of symbiosis, of community life are the subjects we have to investigate. It would naturally be wrong to compare this symbiosis with the social life of sentient man, the latter being quite another category. Therefore the term: sociology was rejected not only by Hungarian and Soviet research workers but even by several western authors and replaced by the expression "coenology".

Biocoenoses and so phytocoenoses have formed not according to accidental, *i. e.* to all statistically possible combinations of species living on Earth, but according to their own regularities in definite compositions. As a consequence of the spherical form and revolution of Earth, the biosphere shows — over and above the aquatic and continental environment — necessarily a zonal arrangement (developed collaterally to the parallels). In the course of the phylogeny of the living over and above the regular geographical distribution of the taxa adapted to different environmental conditions, the life communities can evolve even within identical zones and identical phylogenetic areas only according to finest deviations of the complex effect of environmental factors and just in certain, much more limited combinations.

Phytocoenology developed from physiognomical-ecological phytogeography of the last century in the first quarter of present one. Its views and methods, however, are basically different. Whereas the predominantly geographical-descriptive and ecological-biological part of the former displays often a teleological character, latter has synbiological-causal, pragmatic and statistic features. Phytocoenology was launched as a practical science by problems of practice at the beginning of our century (*e. g.* investigations by FRÜCH-SCHRÖTER on the yield of meadows, by CAJANDER and MOROSOW on forest typology) and became — rapidly developing — a science with the task of principle to carry out fundamental researches, but it upheld all the time its close connections with practice.

Researches of that kind have started with great impulse in every advanced country. This field of science was formed in animated discussions and in the course of research work and continues to develop rapidly today also (the views of the different schools are not dealt with here). The new attitude and methods initiated the examination of plant communities and the clarifying of the regularities pertaining to their composition and structure (syntaxonomy), dynamics (syndynamics), development and succession (coenogenetics), distribution (synchorology) as well as to the environmental conditions and their effect (synecology).

In Hungary the phytocoenological school was started and led by R. Soó at the end of the twenties and the beginning of the thirties, continued to develop in various directions after an involuntary wartime interruption. Simultaneously with the formation of the new Hungarian Academy of Sciences, experts of agriculture and forestry were drawn into the community of Hungarian geobotanists and the items of the First Scientific Five Year Plan were discussed and established, together with the tasks to be solved, on the 1st Phytocoenological Symposium held in 1950 in Vácrátót as an initiation. A country-wide co-ordinated geobotanical mapping was systematically started and in order to fix uniform fundamental and methodological points of view, in 1951 a retraining course with 40 participants was arranged in Vácrátót again. (By the way it should be mentioned that the mimeographed lecture notes of this course are a source of references on basic researches most cited by Hungarian practice.) Ten years later, in 1960, on the 2nd Geobotanical-Phytocoenological Symposium the problems of principle as well as the works referring to the 51th (then 69th) main task of the Perspective Scientific Plan of Researches elaborated by the preparatory commissions were discussed again in accordance with the further development in this field of science. Since on the division sessions of the General Assembly of the Hungarian Academy of Sciences held in 1959 and 1961 a summarizing report on the results hitherto achieved was given by the author and the Academician R. Soó, a new recapitulation seems to be dispensable. Instead of that, reviewing theoretically the attitude and character of this branch of science, the solution and practical importance of some questions pertaining to basic researches should be pointed out.

Phytocoenology is a science chiefly of statistical character. This statement refers to all its branches, to syntaxonomy, synchorology, synchronology and synecology in the same way. So the concepts used when analysing the composition or structure of plant communities or associations *e. g.* abundance-dominance (AD), dispersion-frequency (Fr), constancy (K), group-allotment (GA) or group-mass (GM), as well as the mycocoenosis index and complex dominance in the coenology of fungi, are all concepts of statistical character. The segregation of these into groups of analytical and synthetical type in textbooks reveals that the methodology of phytocoenology is characterized by the dialectic interweaving of analysis and synthesis. The latter — following the analytical procedure — means essentially type-forming. The establishment of types by the aid of comparative observation ("vergleichende Betrachtung") is a so-called tabular work based on statistical positive data of quality and quantity. To supervise correctly the accuracy of the ascertained, regularly recurring composition of vegetation, repeated analysis and control are needed both in the field and in practice.

The material for statistical elaboration is collected by the phytocoenologist himself. As plant communities have a regular composition and structure, and their formation is not based upon statistical random, it is unnecessary to survey and analyse many stands in the field; a restricted number of them will yield satisfactory results. Moreover, the examination of a relatively homogeneous bulk developed on the basis of specific regularities requires no investigations comprising the whole bulk, respectively all the stands; the analysis may be performed on the strength of a part or sample plots picked out from the bulk and the synthesis may be generalized for the whole bulk or all stands.

Consideration of the so-called minimareal (which is of different extent) and the completeness of tallying must naturally be looked upon as basic preconditions for surveying the associations and their parts.

The categories established, the associations are realities concretely existing in the nature and recurring regularly under specific conditions in their stands. Just this is why the basic units of phytocoenology *i. e.* the associations and the categories falling under them are apt to

serve also as comprehensive categories of the corresponding units of practical forest- and meadow-typology. So the knowledge of regularities established by basic researches on the composition, structure, dynamics and synecology of plant communities can be applied — by the aid of a short transmission — to practice. (It should be stressed that this can be done despite the fact that the direct causal connections of the processes could not be clarified and their segregation according to the different decisively effective factor not be performed till now. Hybrid maize is utilized with considerable success by agriculture though the final causes of the heterosis phenomenon are not elucidated so far.) And really, together with the achievements of forest investigations, the results of phytocoenological basic research gained during the last 10 years in Hungary can be applied — according to the instructions of the General Directorate of Forestry — in all forestry establishments of the country, as it is proved by the Instructions for Forest- and Site-Typology issued recently. Not a practical adoption of partial results is aimed at, but according to the tendency manifesting itself in advanced countries everywhere, the whole Hungarian silviculture should be developed on the larger theoretical fundaments of biocoenological attitude. So the units of silviculture, regeneration and forest management, *i. e.* the forest types will be identical with the different categories of phytocoenology. In this respect especially the important effects of the plan-work carried out in the Bükk-Mountain may be referred to.

As against yearly cropping agriculture, forestry is not able to apply intensive agrotechnics, because due to slower growth of trees, logging cannot be practiced every year but according to the working plan only after 4 to 10 decades; therefore it may produce larger quantities and more economically — among other things — by increased utilization of biological regularities.

It does not suffice for practice either to select only a part of the phytocoenosis, *e. g.* the dominant species of a forest stand or meadow, the phyto- and biocoenosis must be estimated together with the site in its entirety. From this aspect SUKACHEW's concept and theory of biogenocoenosis is really a perfect one. Every practical typology built up merely on one or two selected features, *e. g.* only on a stand of trees, or simply on the undergrowth or purely on the soil is not only principally erroneous in its view, but cannot lead to success in practice either. In Czechoslovakia *e. g.* the experiment to classify for the practice meadows and pastures exclusively on the basis on their dominant plant species (GREBESNIKOW) proved a fiasco. The forest typological summary of the Roumanian forestry (PASCOWSKI) stresses exceedingly the dominance of trees and therefore stands of identical dynamics but belonging to the same plant community were ranged into different groups and also the number of types was too much increased. In Hungary the close co-operation with forest research workers since many decades, the exchange of experience, many debates held in the Academy and by foresters resulted in an essentially proper solution. The typological examination of forests, meadows and pastures, however, should be continued. *E. g.* in phytocoenological basic research it is also desirable to conduct, according to the needs of forestry, more detailed qualitative and quantitative analyses on the structure of stands or even to carry out the synecological survey more intensively.

In addition, phytocoenology is a characteristic spatial science, comprising not only biological but also geographical features. Distribution of the vegetation in space, its spreading on the surface of Earth have their own specific regularities as well. The natural conditions of each region, its possibilities for agriculture and forestry are reflected excellently by the plant cover being more or less in natural state.

Geographically all regions have an individual character to a certain degree. A concrete region is not to be found in an other part of the Earth again; it appears with its general effects and their consequences as a unique phenomenon. Just this is the fact which requires — among others — the so-called "rayonization", *i. e.* the organization of agricultural and forest production according to regions (rayons). Besides synecological regularities of general validity under different climates, on different soils and — generally speaking — in different regions, the partial regularities manifest themselves differently as a result of the complex total effect of the dissimilar factor; this is chiefly due to the universally effective rule that in the complexity of factors each of them can be substituted by others. To understand these connections is most important for practice above all. According to differences in climate, soil, environment and region the various plant species show dissimilar synecological demands. Therefore it is of decisive account for every country to ascertain scientifically the locally valid factor complexes reflected most expressively by the plant cover, because such surveys render possible to utilize best the regional conditions of the country and to convert them in some degree. This work is performed by national phytogeographical mapping, in some respects similarly to geological and pedological mapping, however, not in the whole area but by selecting sample plots. The regularities established on the latter may be applied to the whole region.

The utilization of the results gained in mapping of Hungarian plant communities may also contribute to the solution of the complex tasks of country and regional planning, for about one third of the country's area is covered by forests, meadows and pastures, *i. e.* by more or less natural plant communities.

Phytocoenology examines the several plant communities not only in their momentary state or — more precisely — in their yearly rhythm, but considers also the development, historical past and succession of phytocoenoses, so it has a historical character too. This trend should only be touched here and will be elucidated by an example offered later.

Since its emergence phytocoenology is not a simple fact-finding, merely descriptive, but a causal-pragmatic branch of science. This statement is proved — among others — by the evidence that the first handbook on phytocoenology (by BRAUN—BLANQUET), a fundamental work even on international level, presents for two-thirds synecology already in its first issue (edited in 1927).

Causality is the basic form of correlation and interaction of things. The reason must and may only be examined always in a given correlation, for in another connection — as it is well known — cause and effect will differ from that in the first instance. The examination of cause and effect should also be performed in phytocoenology according to the different parts, various categories of this discipline on different levels. *E. g.* the question concerning the reason of the formation of a vegetation-zone (effect) can be answered only by designating a cause or causes expressing a comprehensive concept similar to the vegetation zone, such as the climate under a high parallel, but by no means can a temperature or temperature interval be considered as proper concept. As a concrete example it may be mentioned that according to the vegetation map of Earth in the interior of the Eurasian and North-American continents the zone of coniferous forests and of the taiga, respectively, adjoins immediately the steppe or the prairie, whereas the zone of broadleaved woodlands is missing. This is caused by the extremely continental climate and corroborated by the fact that the phenomenon mentioned appears on both continents as a reflection of a mirror. In Eurasia the Atlantic climate is confined to the western, in North-America to the eastern part of the continent, so the zone of hardwood forests could be formed only there.

On the succeeding level, *i. e.* in the category obtained by further parcelling, when the basic unit of phytocoenology, the association, is pragmatically examined, the reason or reasons may be divided into factor complexes such as coenogenetic process, relief, meso- and microclimate, genetic soil type, and these, again, can even be disintegrated into partial factors such as evaporation or pH, as it will be demonstrated later by the second example. On this level the chief method is the comparative attitude, resting on an empirical-statistical basis; experiments may mostly be conducted on practical management scale.

The next, third level serves for the causal study of selected parts of the association and permits already a partition into directly acting, decisive factors, *e. g.* concrete temperature intervals, extreme temperatures, Ca-cation content of the soil. The method here is for the most part empirical-statistical too, although this level is called experimental ecology in international literature. Indeed, application of experimental methods is possible, if they are especially justified and rational. In connection with this question, reference may be made to the different experiments on relevant matters conducted in the Botanical Research Institute of the Hungarian Academy of Sciences (chemical weeding, soil-biological investigations) and in the Botanical Institute of the University of Agricultural Sciences at Gödöllő (joining of grasses, etc.).

It seems necessary to conclude these thoughts with the remark that it is wrong even from the aspect of epistemology if a causal analysis elaborated on comprehensive conceptual level is termed as primitive causalism.

By clarifying the closer causal connections, the results of pragmatical phytocoenology and synecology attained on the second and third level may promote in many relations the proper selection of procedures to be applied in agriculture.

In order to elucidate the above statements more intensively, the following three partial results of scientific investigations are presented as examples:

1. Palynological-coenogenetical considerations on beech-dominated relic forests.
2. The problem of the woody steppe in the light of coenodynamics.
3. Experimental ecological examination of a forest plant indicating lime (Lithospermum purpureo-coeruleum).

THE WOODY STEPPE PROBLEM IN THE LIGHT OF COENO-DYNAMICS

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We have to share the statement of B. ZÓLYOMI that in the region of the woody steppe the mosaic of forest and steppe shows a zonal arrangement, *i. e.* in the competitive vigour of dominant species belonging to various plant communities an increase or decline is induced by minimum differences in the total effect of external ecological factors, and it is this, which determines whether a woody steppe forest or a woody steppe meadow develops on a given tract.

Just this is, too, the situation on the Hungarian Great Plain (Alföld). From this flatland only that part could be looked upon as steppe, where according to KÖPPEN's formula: $P = 2(t + 14)$ the yearly precipitation remains below $2(10 + 14) = 2 \times 24 = 48$ cm. (= 480 mm.) or $2\ (10.5 + 14) = 2 \times 24.5 = 49$ cm. (= 490 mm.) *i. e.* below 485 in average. Such a region, however, does not exist on the Alföld. But in some years it may happen that precipitation does not reach this level. So according to observations covering 50 years the amount of precipitation remained below the above-mentioned limit of drought on following meteorological stations for a lot of years expressed as percentage of the whole period: Békéscsaba 28%, Fegyvernek 32%, Jászberény 36%, Kecskemét 32%, Orosháza 38%, Püspökladány 30%, Szeged 30%, Szentes 32%, Túrkeve 34%. — The situation is worsened by the fact that in such dry years temperature usually increases above the average.

Such years of drought are definite criteria of the possibilities of silviculture. The climate of the Alföld is not strictly a forest climate, therefore the higher water demand of forest vegetation may be satisfied by the various sites only if the water regime of the soil is improved to an adequate degree by various factors, *e. g.* by being favourably situated, collecting precipitation from the environment, having the table of underground water near the surface, etc.

For expressing or portraying the total effect of site factors no precise measures, gauging devices are available as yet. So the establishment of this general impression is a very difficult problem, in the solution of which considerable aid may be expected from phytocoenology. Since the permanently developing plant cover can be regarded as the total effect of ecological factors, it is quite clear that *e. g.* for successful afforestation work on the Alföld foresters must utilize the attainments afforded by phytocoenology. In connection with this matter it must be stressed that the site indicating value of sand vegetation, its practical importance and usefulness in planning of afforestations on sand areas was discovered by two excellent Hungarian foresters, N. ILLÉS and F. KISS already at the end of the last century. Researches continued to develop the method of the latter according to the classification given below.

Brometum tectorum. Lime-demanding (calcipete) annual sand turf. In lower sites as leading species *Scots pine (Pinus silvestris* L.) and *Hungarian native poplars*, as admixed species *hackberry (Celtis australis* L.), *field maple (Acer campestris* L.) and *shrubs*, in places sheltered against wind chiefly *grey poplar (Populus canescens* SM.) should be planted. In higher levels (where the ground water table is below 2.5 to 3.0 m.) as main species *Austrian pine (Pinus nigra* var. *austriaca* HOESS), for admixing *Scots pine*, *black locust (Robinia pseudacacia* L.), *hackberry*, *white poplar (Populus alba* L.), *common juniper (Juniperus communis* L.) and *eastern redcedar (Juniperus virginiana* L.) are advisable.

Festucetum vaginatae — Calcareous sand steppe.

a) *Salix rosmarinifolia* subass. *(Festucetum vaginatae salicetosum rosmarinifoliae).* — Principally good for *Scots* and *Austrian pine* as well as for *white* and *grey poplar* appearing otherwise frequently on such sites.

b) *Holoschoenus romanus* subass. — Ecologically very similar to the former, so from the aspect of afforestation no differentiation necessary.

c) *Stipa capillata* subass. *(Festucetum vaginatae stipetosum capillatae).* — Soil meets hardly the demands of black locust; *Scots* and *Austrian pine*, on the other hand, can successfully be planted. It is justified, in pinewoods to plant *black locust* 10 to 15 per cent and sporadically with *hackberry* and *boxelder (Acer negundo* L.)

d) *Stipa pennata subass. (Festucetum vaginatae stipetosum pennatae).* Extremely dry site, affording possibilities only for *Austrian pine*, occasionally for *eastern redcedar* and *common juniper.*

e) *Festucetum vaginatae normale.* — Mixed stands of *Scots* and *Austrian pine* may be established and *eastern redcedar* can also be taken into consideration. For sporadical admixing, *hackberry* and *boxelder*, in stands of Austrian pine 10 to 15 per cent of *black locust* are justified.

f) *Fumana procumbens* subass. *(Festucetum vaginatae fumetosum).* — Site may be regarded as sterile barren land and it must be temporarily excluded from afforestation plans.

g) *Juniperus communis* subass. *(Festucetum vaginatae juniperetosum).* — Variations of site more or less similar to those of *Festucetum vaginatae* dealt with here, so in choosing of species identical points of view prevail.

h) *Populus alba* subass. *(Festucetum vaginatae populetosum albae).* — In the work of afforestation chiefly filling of gaps in natural regeneration should be aimed at.

Festuco (vaginatae) — Corynephoretum. Sand steppe poor in lime. — Here for afforestation *Scots pine* is the most suitable species. It should be mixed with *European white birch (Betula pubescens* Erh.), *white poplar, Turkey oak (Quercus cerris* L.), *hackberry* in lower and medium levels and with *hackberry, eastern redcedar* and *Austrian pine* on higher sites.

Astragalo-Festicetum sulcatae. — Sand steppe meadow. — Represents the best variation of non-forested sand soils in Hungary. The chernozem-like soil with a humous upper layer often of 40 to 60 cm. thickness is suitable for growing *pedunculate oak (Quercus robur* L.), *European ash (Fraxinus excelsior* L.), *English elm, maple (Acer* sp.), and *black locust.*

Poorer variations of site are indicated by different facies and the choice of tree species is carried out accordingly.

Agrosti-Molinietum danubiale. — Depression among sand dunes. — In the first place *European alder (Alnus glutinosa* Gaertn.), *Willow* and occasionally *Scots pine* should be considered for planting.

Agrostetum albae hungaricum. — Swamp meadow of the Alföld. — Soil today not sodic, a permanent or longlasting inundation is not to be feared; *pedunculate oak, European ash, English elm (Ulmus grabra* Mill.), *native poplars* and *black poplar hybrids* promise good results. Where the humous layer is too thin and the soil wet, only *European alder* and *white willow (Salix alba* L.) are advisable.

The results of phytocoenological researches, however, are not merely necessary when afforestation of sand sites is planned but may provide forest practice with, fundamentally important hints also in other fields; they are not superfluous for the procedure of tree planting on alkali ("szik"-)soils either. Not because the data on the composition of plant cover would furnish reliable and precise information as to the quality and afforestation possibilities of szik soils; such demands would be exaggerated. Phytocoenological knowledge cannot substitute investigations in soil laboratory. But *e. g.* if the question must be answered whether it is worth to deal with the afforestation plan of a more or less sodic soil and, consequently, with carrying out intensive soil examinations or not, in such cases the proper interpretation of the plant cover is of high importance. *Camphorosmetum annuae, Puccinellietum limosae, Puccinellietum peisonis, Lepidio-Puccinellietum peisonis, Lepidio-Puccinellietum limosae, Suaedetum maritimae hungaricum, Salsoletum sodae, Crypsidetum aculeatae* prove alike that the sites of these associations are entirely unsuitable for tree planting. But if the plan can provide also for the expenses of chemical soil improvements, a more thorough examination of the soil of *Artemisio-Festucetum pseudovinae* seems justified. The laboratory soil investigation of *Cynodonti-Poetum angustifoliae* and *Achilleo-Festucetum pseudovinae* is always advisable, for the plant cover does not reliably disclose a hidden alkalinity. Moreover, these examinations should be performed for the very reason of deciding on the necessity and methods of an occasional soil improvement.

These items do not cover at all every field in which phytocoenology may help and actually supports forest practice; so neither natural regeneration, stand tending, forest protection, etc. nor the possibilities arising from them were mentioned here.

Abstracts of papers read at the sessions of section A

EFFECT OF VIRUS INFECTION ON THE HYDROGEN AND ELECTRON TRANSPORT SYSTEMS OF THE HOST TISSUES

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Studies on virus-infected local lesions of host plants indicated a marked increase in the activity of dehydrogenases in the tissues around the lesions as shown by the in vivo application of the triphenyl tetrazolium chloride technique. The aim of the present study was to elucidate the nature of the activated metabolism in this area.

Enzyme activities were measured in cell-free extracts from the tissues near the lesions and from the healthy areas of the same leaves (control) by standard spectrophotometric techniques. *Nicotiana tabacum* var. White Burley plants infected with the para strain of tobacco mosaic virus were used.

Most of the enzymes studied were found to be activated in the tissues surrounding the lesions. The following average values of stimulation were obtained (control 100%): glucose 6-phosphate dehydrogenase 255%, 6-phosphogluconic dehydrogenase 305%, cytochrome oxidase 148%, $NADPH_2$-dependent quinone reductase 138%, $NADH_2$-dependent quinone reductase 169%, polyphenol oxidase 200%, "$NADPH_2$ oxidase system" (oxidation of $NADPH_2$ by crude extracts without adding extra carriers) 188%. No change was experienced in the activity of phosphohexoisomerase, pentose-phosphate isomerase and malic dehydrogenase.

The above results indicate that mainly the hexose monophosphate shunt dehydrogenases are activated and also, to a lesser extent, systems capable of transferring electrons from reduced dinucleotide coenzymes via polyphenols and polyphenoloxidase or via unknown carriers ("$NADPH_2$ oxidase") to the molecular oxygen of air.

Pentoses accumulate in the tissues studied and ribose 5-phosphate added to the extracts is but slowly metabolized. This suggests that the later stages of hexose monophosphate shunt cannot cope with the strongly activated first steps of the pathway.

The higher activity of a number of enzymes in the tissues around the lesions is most probably due to enzyme protein synthesis. This idea is supported by preliminary results obtained with ^{32}P indicating a higher turnover of ribonucleic acid in the affected area. As to the biological role of the observations described it might be assumed that the localized acquired resistance of plant tissues to viruses, *i. e.* the phenomenon that the tissues around the local lesions are as a rule resistant to reinfection, has to be explained by a competition between viral and enzyme protein syntheses.

CONTRIBUTION TO THE BIOGENESIS OF 3-INDOLYLACETIC ACID IN BAKERS' YEAST

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The occurrence of 3-indolylacetic acid (IAA) in yeast is well known. To elucidate the biochemical steps resulting in IAA different precursors were added to baker's yeast suspended in a 1 per cent glucose solution in tap water; after shaking for 48 hours at 25° C the suspensions were centrifuged and the supernatants paperchromatographically analysed. To demonstrate the IAA and tryptamine the supernatants were extracted with peroxyde-free ether. For the demonstration of indole and tryptophane the supernatants were evaporated in water bath and the residues solved in ether or ethanol respectively. Chromatograms were run in the case of indole with isopropanol — ammonia — water (10 : 1 : 1) solvent while in the other two cases

with butanol — acetic acid — water (2 : 1 : 1) solvent. The chromatograms were developed with the Gordon—Weber and ninhydrin reagents respectively. Having added anthranylic acid to the suspension, indole could be demonstrated. Synthesis of tryptophane after adding indole + serine could be also established. Nowadays tryptophane is generally accepted as a precursor of IAA. In our experiments addition of tryptophane resulted in the increase of IAA. The spot of tryptamine identified by R_f (0.75) as well as by colour reactions was also demonstrated. Decarboxylation of tryptophane was also observed in a suspension of an acetone-preparate of the yeast with Warburg method. Tryptophane was added in methanolic solution (1 mg in 0.1 ml) to the side bulbs. Following the cessation of the endogenous increase of pressure the tryptophane solution and the pure solvent respectively were tipped to the suspensions. The increase of pressure due to the addition of tryptophane was very slow ($Q_{CO_2} = 0.2$ at 25° C). On the evidence of the above-mentioned data the following biochemical steps were demonstrated in baker's yeast: anthranylic acid → indole; indole + serine → tryptophane; tryptophane → tryptamine + CO_2; tryptophane → IAA. Consequently, tryptamine may be supposed to be an intermediate in IAA biosynthesis.

ALKALOID PRODUCTION BY CLAVICEPS PURPUREA TUL. IN SAPROPHYTIC CULTURE AS AFFECTED BY CYTOSTATIC SUBSTANCES AND VARIOUS EXTRACTS FROM MEDICINAL PLANTS

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The effect on the alkaloid production in saprophytic ergot cultures of some cytostatic substances and extracts from medicinal plants was studied. It was the purpose of these investigations to gain a deeper insight into the biosynthesis of ergot alkaloids. Preliminary experiments were carried out in saprophytic surface culture of an ergot strain of the ergotoxin type, producing 0.1 to 0.5 per cent alkaloid in normal conditions. The fungus was cultivated on a synthetic agar medium containing saccharose, succinic acid and inorganic salts. The pH was adjusted to 5.6 by NH_4OH. The cultures were incubated in a thermostate at 24° C for 21 days. By the end of the incubation the alkaloid content of the dried mycelia was determined by paper chromatography and photometry (Van Urk reaction; blue color formation). Water extracts of podophyllin, resin, degranol, colchicine and those prepared from evaporated alcoholic extracts from drugs of *Vinca rosea*, *Symphytum officinale*, *Papaver orientale*, *Calendula officinalis*, *Asperula odorata*, *Populus nigra* and *Sedum acre* were added to the cultures. The *Populus* extract in higher concentrations totally inhibited fungal growth and in lower concentrations inhibited the alkaloid production. The *Asperula*, *Symphytum*, *Papaver* and *Calendula* extracts also reduced the production of ergot alkaloids. The *Sedum* extract had no marked effect on alkaloid synthesis. The effect of *Vinca* extract and that of the podophyllin resin and colchicine greatly depended on the physiological properties of the inoculum in the ergot culture. In some experiments stimulation, in others inhibition was obtained. Degranol stimulated alkaloid biosynthesis up to a concentration of 20 γ/ml and exerted an inhibitory effect in higher concentrations. The effect of *Populus* and *Asperula* extracts added to the culture medium of the inoculum was stronger on cultures deriving from treated inocula and grown on control media than on cultures treated directly. Experiments were carried out with submerse cultures of ergot as well. It has been found that no more than 6 γ/ml degranol stimulated the alkaloid production to some extent. Higher concentrations and other substances had a more pronounced inhibitory effect with submerse than with surface cultures. The treatments had no effect on the alkaloid spectrum. The growth of mycelia was affected by the *Populus* extract only.

ON THE CAROTENE CONTENT OF SOME UNICELLULAR ALGAE

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Fifteen different pure algal strains were grown in 10-litre sphaerical flasks containing nutrient solutions prepared from tap water with the addition of KNO_3, KH_2PO_4, ferric citrate and citric acid.

The supercentrifuged living material was used for analysis. The α- and β-carotenes were separated from carotenoids in magnesia-Hyphlo super cel column and their quantity was determined spectrophotometrically.

Strains rich in carotenes are: *Chlorella vulgaris* ($\alpha = 21.5$; $\beta = 61.4$), *Chlorococcum botryoides* ($\alpha = 3.9$; $\beta = 68.9$), *Scenedesmus acuminatus* ($\alpha = 5.6$; $\beta = 59.9$), *Scenedesmus obtusiusculus* ($\alpha = 30.5$; $\beta = 81.6$ mg per 100 g dry matter). Strains with low carotene content: *Coelastrum microporum* ($\alpha = 14.0$; $\beta = 26.2$), *Scenedesmus acutus* ($\alpha = 3.7$; $\beta = 27.0$) and a senescent culture of *Chlorella vulgaris* ($\alpha = 0.7$; $\beta = 25.2$ mg%). *Chlorella pyrenoidosa*, *Chlorocloster terrestris*, *Oocystis* sp. and one indetermined species occupied places between the extreme values. α-carotene was found in all species investigated which may be accounted for by the fact that living material (not dried) was used for analysis.

Carotene content considerably varies in the different algal strains and is dependent also on the physiological condition (*e. g.* age) of cultures. Unicellular algae are specially suitable objects for studying both biochemistry and physiological role of polyene pigments, due to their physiological plasticity and the practically unlimited possibilities of changing their cultural conditions.

THE POTAMOPHYTOPLANKTON OF THE KÖRÖS RIVER AND ITS SAPROBIOLOGICAL CONDITIONS NEAR GYOMA

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Invited by the Research Institute of Water Resources the author conducted complete saprobiological and limnological examinations three times on a profile of the Körös river near Gyoma. The hydrochemical data given below were simultaneously determined by the Hydrochemical Laboratory of the Water Conservancy Directorate of Szeged (J. Szépfalusi). The samples were taken at distances of 1 m and then at every 10 m from the banks and downward per metres, using horizontally situated Ruttner-bottles modified for fluvial research. Hydrochemical data in October 1960 (time of autumnal low water): O_2-consumption = 5.88 mg per litre; BOD_5 (bio-organic demand) = 1.65 mg/l; ammonia = 0.40 mg/l; total hardness = 8.22 GH° (German hardness degree); pH = 7.2. At this time the plankton algal population was dominated by the diatoms (Bacillariophyta) *Bacillaria paradoxa*, *Melosira varians*, *M. italica*, *Surirella robusta* var. *splendida*, *Synedra ulna* and the green algae (Chlorophyta) *Pediastrum duplex*, *Closterium moniliferum*, *Spirogyra* sp. A quantitative analysis of the coenoses gave the following saprobiological valuation: rate of β-mesosaprobiontic organisms = 59 to 76%; β—α-mesosaprobiontic organisms = 7 to 18%; α-mesosaprobiontic organisms = 1 to 2%, saprobiologically not determined organisms = 16 to 28 %. Hydrochemical data in February 1961 (ice drift): O_2-consumption = 11.90 mg/l; BOD_5 = 2.24 mg/l; ammonia = 0.27 mg/l; total hardness = 8.48 GH°; pH = 7.2. In the plankton the following dominating species were found: the diatoms *Synedra ulna*, *Surirella ovata*, *Melosira varians*, the green algae *Eudorina elegans*, *Ulothrix tenuissima*, and Hyphomycetes *Leptomitus lacteus* and the bacterium *Cladothrix dichotoma*. Rate of oligo-β-mesosapromiontic organisms = 2 to 5%; β-mesosaprobiontic organisms = 22 to 31%; β—α-mesosaprobiontic organisms = 7 to 28%; α-mesosaprobiontic organisms = 4 to 12%; α-mesopolysaprobiontic organisms = 5 to 22%; saprobiologically not determined organisms = 27 to 40%. Hydrochemical data in June 1961 (dammed summer water): O_2-consumption = 7.66 mg/l; BOD_5 = 0.88 mg/l; ammonia = 0.09 mg/l; total hardness 6.03 GH°; pH = 6.8. The dominant plankton algal population showed a larger bulk of the diatoms *Surirella robusta* var. *splendida*, *Nitzschia palea*, *Synedra ulna*, *N. acicularia*, of the green algae *Pediastrum boryanum*, *Closterium acerosum* and of the yellow alga *Dinobyron divergens*. Saprobiological data: β-mesosaprobiontic organisms = 12 to 21%; β—α-mesosaprobiontic organisms = 40 to 47%; saprobiologically not determined organisms = 39 to 45%.

The analysis of potamoplankton coenoses comprised 152 species providing thus — together with hydrochemical examinations — a fairly broad basis both for water qualification and for surveying the algal vegetation of this river bed section. The most conspicuous result of saprobiological analysis is that in the low winter water and in the dammed summer water a quality worse than β-mesosaprobiontic is indicated by more than half of the determined algal organisms. This and the fact that a bacterium quantity unusual in rivers was present in most samples of the Körös, together with the relatively high level of O_2-consumption revealed that the Körös near Gyoma is carrying a water eutrophic above the fresh-water average of the Hungarian Great Plain (Alföld). The winter and summer samples indicate saprobiological conditions below acceptable level.

INVESTIGATION OF THE MINERAL NUTRITION OF DATURA INNOXIA

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Datura innoxia plants were raised in washed sand in pots and given nutrients adequate for the realization of nutrient deficiency, optimal and excessive supply. 5 different N treatments (30, 150, 600, 1200 and 2400 mg N per pot) and 5 P-dosages (9, 45, 180, 360 and 720 mg P per pot) were applied in 25 combinations. The nutrient contents of leaves were determined by wet digestion with sulphuric acid, the alkaloid contents with the acidimetric method. The results are as follows: The connection between the exterior N-P levels and the growth is characteristic: plant weight was more increased by higher N than by higher P dosage, furthermore, the optimal external nutrient level is increasing with higher quantities of the other nutrient. With the increased N or P level respectively the per cent of N or P in the leaf increases according to a saturation curve. The external N-level did not influence consistently and essentially the interior P per cent, neither did the exterior P the N per cent in leaves. The critical N concentration rises linearly with the increase of P supply from 2.5 to 5.0 per cent, whereas the critical P per cent increased with the growing N supply according to an exponential curve from 0.23 to 0.46. The maximum alkaloid per cent is found at low to medium external N and P supply while high alkaloid per cent occurs at two spots: at high deficiency of N and P and (the greater maximum) at medium N and high P level. No relation was found between the N and alkaloid per cent of the leaves; the linear correlation between the P per cent and the alkaloid per cent is significant at the 1%-level. The maximum of alkaloid yield (= alkaloid per cent × dry weight) is at medium external N and high P level. For the alkaloid yield critical N and P concentrations can be given. This value, however, does not depend on the supply with the other nutrient: N = 3.5 per cent, P = 0.32 per cent.

THE BIOSYSTEMATICS OF THE HUNGARIAN POLYPODIUM VULGARE S. 1.

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Previous morphological observations (ROTHMALER, MARTENS) have already proved the heterogeneity of the European *Polypodium vulgare*. The cytological examinations by MANTON and SHIVAS revealed that the different types belong to three ploid levels (being di-, tetra- and hexaploids). In the meiosis of polyploids no multivalents exist, so an autoploid series is not to be thought of. By investigations on the meiosis of hybrids also the origin of these types could be clarified. The Mediterranean *Polypodium australe* FÉE *(serratum)* and the American *P. virginianum* L. are diploid species. *Polypodium vulgare s. str.* having *P. virginianum* as one of its parents and most common in Europe as well as in Hungary is an allotetraploid species. In the meiosis of the hybrid *P. vulgare* × *australe* there are no bivalent forms, accordingly both parents are of different origin. The hexaploid *P. interjectum* MANTON et SHIVAS came into being by crossing of the European di- and tetraploid species after doubling of the chromosome set.

Since 1960 many *Polypodium* populations were analysed in order to establish the cytotaxonomic place of the Hungarian *Polypodium* types as well as their area and ecological demands. The determination of chromosome numbers was conducted in the meiosis of spore mother cells. On the strength of these investigations it could be pointed out that in Hungary two *Polypodium* species are living: the tetraploid *P. vulgare s. str.* and the hexaploid *P. interjectum*. The former grows on many sites of the Hungarian Medium Mountain (Magyar Középhegység) and Transdanubium (Dunántúl), the latter in the mountains of the Mecsek, in the western part of the Medium Mountain, exactly from the region of the Lake Balaton till the Naszály mountain and in the southern mountains of the Bükk. The sterile pentaploid hybrid of these two species *(P.* × *mantoni* ROTHMALER) was hitherto discovered in the Mecsek (on the Misina mountain) and in the Bakony (Cuha valley). It is presumable that this hybrid is the result of a crossing in earlier times, because it forms today extensive clones, even in absence of the parental species. The ecological demands and accordingly the sociological role of *P. vulgare s. str.* and *P. interjectum* are also different. *P. vulgare* is frequent an acidic soils, whereas *P. interjectum* appears on limestone and dolomite base rock as well as on the less-basic soil of the basalt cones near the Balaton. *P. vulgare s. str.* may most frequently be found in the rupestrine

grasses of Asplenio-Festucion glaucae and the forest alliances Quercion robori-petraeae, Luzulo-Fagion and Pinion. The hexaploid *P. interjectum* prefers the alliances Seslerio-Festucion, Acerion and Orno-Cotinion. The heterogeneity of the tetraploid *P. vulgare* indicates a further cytogenetic problem. Thorough investigations may probably disclose the existence of an other tetraploid genom combination in which perhaps also *Polypodium australe* occurs. However, on this matter no positive cytogenetic data are available so far.

THE FAMILY RELATIONS OF CYCADACEAE

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Modern paleontologists, so REMY, LECLERQ and others, divide the species of Psilophyta according to the form of their ramification into three groups, called monopodial, dichotomic and verticillate types. Among Psilophyta especially *Asteroxylon* shows anatomical features appearing also in Cycadaceae in the same manner. Really, *Asteroxylon* is not a true *Asteroxylon*, because the vascular bundles of its xylem do not ramify stellately, but in perfect dichotomy. The spiral and scalariform thickenings of tracheids in Psilophyta are the same as in Cycadaceae and especially the latter correspond with those in Zamia and Stangeria species. Among Pteridophyta chiefly *Stilites* ans *Isoëtes*, but particularly *Sigillaria*, *Pleuromeia* and *Nathostiana*, show an anatomy similar to the xylem structure of recent Cycadaceae, their close relation is, therefore, indisputable. *Sigillaria* had just a developed system of medullary rays like recent Cycadaceae have and also the scalariform pitting is entirely similar to that of *Zamia* and *Stangeria*. Ramifying Sigillaria were certainly of dichotomic type as are recent Cycadaceae. In the xylem of *Protopitys buchianus* and *Völkeliella refracta* the bordered pits of tracheids are completely identical with those on the tracheids of *Eucephalartos gratus*. The 3- to 5-lined araucaroid pitting of tracheids in the *Dadoxylon* and *Cordaites* species of the Carbon epoch is fully similar to that in some Cycadaceae, it is very difficult to distinguish both from one another. In the root stem of recent *Macrozamia miquellii* we find the same polystelia as in some *Medullosa* species. The utmost ramifications of nervure in the leaves and in occasionally forked stems of Filicinae are dichotomous, just as *e. g.* in palms or in *Dracaena* species. Dicotyledonous trees of perfect dichotomic ramification do not exist, this phenomenon occurs only among ferns, Cycadaceae and monocotyledons; *e. g.* the ramification of root hairs in wheat is perfectly dichotomous. The parallel leaf nervure may be traced back to dichotomy as well. Dichotomy is a phyletic feature which may be ascertained from Psilophyta through Cycadaceae till angiosperm plants. Accordingly Cycadaceae are related to all plant types which show either a dichotomic ramification or dichotomy manifests itself in root hairs. Apart from anatomical characteristics, also the epidermis of leaves and especially the form and structure of stomata constitute a proper basis to conclude to certain family relations. *E. g.* as to the structure of stomata, *Lyginodendron oldhamium* is entirely identical with *Zamia muricata*, the Jurassic *Elatocladus ambluse* with *Macrozamia miquellii*, the species of *Ctenis* are identical with those of *Stangeria* and the species of *Elatocladus* with *Dioon edule*. In the opinion of the author recent Cycadaceae may be looked upon as intermediate forms between Filicinae, Pteridospermae and Monocotyledons.

A NEW SEDUM SPECIES IN THE MECSEK-MOUNTAINS

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Sedum acre L., which occupies an extensive area, is not only morphologically, coenologically and ecologically very variable but its alkaloidal composition is rather inhomogeneous too as are shown by the paper-chromatographical examinations of the collection of clons established from materials gathered from different localities of Hungary, and of foreign countries. The quantity of the sedamine namely ranged between the limits 2.08 and 24.96 mg per cent, while that of the sedridine between 0 and 14.4 mg per cent. Most of the morphological varia-

tions of *S. acre* are conditioned upon the different ecological factors, and at the alterations of the latter, the variations themselves generally soon disappear. Therefore the examinations of the clons on a special experimental spot have been carried out for several years under the same soil-, temperature, light and precipitation conditions and relief factors. PRISZTER found in 1959 in the Mecsek Mountains (South-Hungary) on several places a plant which recollected *Sedum acre*, but had conspicuously long leaves. Planted in garden it has preserved for a number years its — following — differing morphological features. Upon analysis of its alkaloids it appeared to be different from all other *S. acre* examined, as it had a prominently high sedridine ($C_8H_{17}ON$) content (on an average 25.8 mg per cent) in contrast to an insignificant sedamine quantity. The sedridine is important in pharmaceutics. — The occurrence of this plant in Hungary seems to be confined to the warm rocky slopes of the Mecsek and Villány Mountains abundant in calciferous rubbles and rich in southern flora-elements (it probably occurs also in the Fruska Gora Mountains). In taxonomical respect it seems to be closely related to *Sedum neglectum* TEN., the area of which extends to South-Italy and the Balkan peninsula. The identification of the two plants can only be attained by the comparison with authentic living specimens of *S. neglectum*. The curt diagnosis and the herbarium plants do not suffice to this end.

Description of plant: A *Sedo acre* L. rhizomate crassiori, foliis oblongis (6—8 mm longis et 2—2.5 mm latis), inferioribus post anthesim caulibus albido-brunneis adpressis, floribus majoribus (12—15 mm diametro), sepalis longioribus, foliis caulinis similibus, inter petala excedentibus, inflorescentiis majoribus, ramis cymae 5—8(—10)-floribus differt. Herba plantae praecipue alcaloidam "Sedridin" continens.

THE FLORISTIC ELEMENTS OF THE DEMOCRATIC REPUBLIC OF VIETNAM

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According to literature, the flora of the area consists of 4668 flowering and 563 cryptogamous vascular plant species. The present author extended his investigations on the proportionally divided half amounts (2500) of the species. In establishing the geographical floristic elements THAI-VAN TRUNG's provisional classification was made use of. The following values were established: *Endemic species :* endemisms of North Vietnam (Bac-Bo): 16.5%; Central Vietnam (Trung Bo) 10.7% (more than one quarter of the entire flora consists therefore of endemisms !); Indo-Chinese species: East Indo-Chinese (Vietnam-Cambodia): 13.2%; Central Indo-Chinese (Vietnam-Laos-Siam): 0.3%; species common to Vietnam and South-China: 5.1%; species ranging over Indo-China: 5%. Total: 51.3%. *Palaeotropic elements :* south-east Asiatic continental species: 2.3%; tropical Asiatic: 3.3%; Indian: 6.6%; Himalayan: 0.9%; Hainan-Taivan-Philippine Islands: 0.7%; Malayan: 4.1%; species ranging over the entire Indo-Malayan area: 1.6%; Polynesian and Australian: 2.0%; African: 1.3%. Total: 37%. *Neotropic elements* (ranging over the tropics of the Old and New Worlds): 0.4%. *Palaeoarctic (boreal) elements:* east Asiatic (China-Japan): 2.2%; Eurasian: 0.2%; circumboreal: 0.3%. Total: 2.7%. *Others :* cosmopolitan: 0.7%; adventive: 0.6%; cultivated: 2.3%; of unknown range: 4.8%. Total: 8.4%. Striking are the great proportion of the endemic species and the insignificance of the Palaearctic elements as against the tropical ones. It is noteworthy that a great number of our Palaearctic ("arctotertiary") genera are represented by tropical species, substantiating the theory that claims the southeast Asiatic origin of our Palaearctic flora. By analysing life habits, information is gained on ecological conditions and vegetational structure in the area: *woody plant species :* high trees (Megaphanerophyta): 5.1%; low and medium trees (Mesophanerophyta): 17%; shrubs (Microphanerophyta): 31.8% (including 7% creeping shrubs!); dwarf shrubs: 2%; woody lianas: 5.2%; woody epiphytes: 0.6%. Total: 61.7%. *Soft-stemmed plants :* soft lianas: 1.8%; soft epiphytes: 5.2%; half-shrubs: 2.5%; plants with rhizomes and bulbs (Geophyta): 0.5%; other perennials: 16.7%; annual and biennial herbs with woodening stems: 1.5%; biennials (Hemitherophyta): 1%; annuals (Therophyta): 5.9%; aquatic and paludal plants (Hydato-helophyta): 0.4%; others: 2.8%. Total: 38.3%. The high percentage of woody plants and epiphytes is characteristic of tropical and subequatorial vegetations.

THE PLACE OF FAGION ILLYRICUM IN PLANT COENOLOGY

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The coenological independence of the Illyrian beech-woods *(Fagion illyricum)* is strongly contested by Central-European authors. The present author upon the investigation of 820 (partly own) surveys wishes to establish the following facts in this context.

Fagion illyricum includes the beech-woods of the Northern and Central Appennines, of the Southern Alps, Dinarides, Southern Transdanubia and the Western Balkans (inclusive of the hornbeam-oak, — rock-andravine forests). These beech-woods are the richest in species in Europe, with about 700 species, as against 400 to 450 species in other similar associations of Central Europe. Whilst the Central-European beech-woods possess no more than 4 or 5 independent characteristic species, the number of the endemic character-species in *Fagion illyricum* is 21. These are: *Anemone blanda* ssp. *macedonica*, *A. trifolia*, *Astrantia elatior*, *A. major* ssp. *illyrica*, *Cardamine trifolia*, *Cyclamen purpurascens*, *Dentaria enneaphylla*, *D. polyphylla*, *D. trifolia*, *Epimedium alpinum*, *Hacquetia epipactis*, *Helleborus atrorubens*, *H. dumetorum*, *H. niger* ssp. *macranthus*, *Homogyne silvestris*, *Knautia drymeia*, *Lamium orvala*, *Lathyrus ochraceus*, *Omphalodes verna*, *Saxifraga rotundifolia* ssp. *lasiophylla*, *Vicia oroboides*. Further 30 species are South-South East-European beech-forest species of wider distribution; besides further 100 differential species complete the species combination of the association group. It is remarkable that *Fagetalia* species display also higher constancy here than in Central-Europe. The centrum of the association group is in the Dinaric Alps; proceeding from here towards any point of the compass the number of the characteristic species diminishes and their role is taken over by the differential species. Very likely the above-outlined vegetation characters were brought about, beyond the present climatic conditions, to the most part causes rooted in the history of evolution and one of the refuge areas of the European beech *(Fagus silvatica)* and even of the European beech forests was here in the ice-age and spread out in the post-glacial to other European areas. This view seems to be supported by the fact that the two genera most closely connected coenologically with the beech forests *(Dentaria, Helleborus)* have their European species development centre also in this area. Also the pollenanalytical results of Gigov may be considered as a further evidence; according to these the beech forests in Serbia came to dominance as soon as in the Atlantic oak-age, *i. e.* 2000 to 2500 years earlier than in Central Europe.

FACTORIAL ANALYSIS OF SOIL-INDICATOR PROPERTIES OF HIGHER VEGETATION

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Abstract not received.

INVESTIGATION ON THE FLORISTIC RELATIONSHIP OF COENOLOGICAL CATEGORIES

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The well-defined floristic composition is to be looked upon as an important criterion of coenological categories. But what are actually the criteria of the characteristic species and their characteristic composition? The totality of species of an association (plant community) or given site is the result of the environment, the physiological properties, competitiveness (*i. e.* the synecological features) of the species and of the historical factors. So it seems not wrong to choose from the species composition expressing the factors mentioned the frequent and constant members appearing regularly as the basis for comparison. The similarity of floristic compositions was examined by using the K-value of Sörensen and the reliability of

the results controlled with the χ-square test. The investigations were carried on in shrub forests of the Karst and in forest associations of sessile oak and Turkey oak. As for the evaluation of the results similar data and experience are not at disposal, the conclusions must not be generalized. The establishments referring to the material examined may be summarized as follows. (1) An association is properly interpreted if the units to be found within it are thoroughly analysed and the concept of the association is determined by generalizing the data thus obtained. (2) As to the species composition also the units within the association may reveal significant differences. (3) Comparing the constant species the differences of floristic composition may be demonstrated more clearly, *i. e.* the constancy shows essentially altered features even in the intraassociation units. (4) Calculating with constant species among the intraassociation units the connection is looser even on lower probability level than among units of higher degree.

ECOLOGICAL AND PRACTICAL RELATIONSHIPS OF FLUCTUATIONS IN PHENOLOGICAL VALUES

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A recording of phenological data of plants is preferably used for the assessment of factors both in theoretical and practical research work. So far, investigators have been content with determining the average date of phenomena. This and the length of the phenophases (*i. e.* the time between the occurrence of the phenomena) sufficed to characterize the effect of treatments or the extent of the influence of environmental factors. Fluctuations of phenological values have hitherto been studied mostly for two purposes: (1) to determine discrepancies due to geographical differences (geographical amplitude); (2) to estimate the range of fluctuations within individual treatments of varietal series (specific amplitude). Observations made on wheat, maize and hop have proved that individual phenological differences occur even within the varieties: individual amplitude represents a theoretically and practically important value. It expresses the interval of time (days) between the occurrence of the earliest and of the latest phenomenon as observed on the individuals of any given stock of plants. The phenoecological manifestation of the individual amplitude can be studied to best advantage with the delayed sowing technique.

Research work made in this connection with *wheat* has shown that the values of the phenological amplitude are suggestive of the course of the curve of optimum distribution in the winter wheat sowing time experimental series. Favourable conditions tend to shorten, unfavourable ones to lengthen the amplitude. It was found that sowing of wheat out of season widened the amplitude quite considerably, *e. g.* it caused discrepancies in the viability of the grains at maturity which is particularly inconvenient with the use of combines because grains of different grade of ripeness are collected in the sacs. This makes storage more laborious, impairs germinatic power, etc. Also maize and hop (in the latter culture the effect of delayed sowing was produced by prussing) have been found to be sensitive to environmental conditions: amplitude becomes wider as soon as they are unfavourable for development. A narrowing of the amplitude from early spring towards summer was obvious for both plants, although untoward factors disturbed this progress to a greater or lesser extent. From experiments carried out so far it is evident that, on account of its sensitivity, the phenomenon of individual amplitude is eminently suitable for the evaluation of new cultural practices and the demonstration of valuable varietal characters.

COENOLOGICAL SYSTEMATIC VALUATION OF THE ITALIAN LOWLAND-FORESTS

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Within the scope of comparative coenological, synecological investigations on the South- and Southeast-European lowland-forests, vegetation studies were conducted in 1961 in Italy by the author.

The geographical conditions of Italy show essential differences according to the various regions. Consequently, as to characteristic species combination, dynamics and ecological demands of the various plant communities, the riverine vegetation of the examined regions displays fundamental deviations.

In the northern plain-type part of Italy comprising — except the foreshore — substantially the flatland of the Po river, the lowland areas are mostly occupied by plant communities belonging to alliances of Middle-European character *(Salicion, Ulmion)*, although Submediterranean and Mediterranean elements of more or less importance may be found in them as well. As to ecological demands and dynamics, the communities remind mostly of those of Middle-Europe. The mixed riverine forests developed on the higher new holocene level of the lowland are similar to those of Croatia *(Querco-Ulmetum slavonicum = Querco-Genistetum elatae* Horvát 38), but today generally secondary types converted into stands of black poplar hybrids are grown in Northern Italy.

The riverine forests of plains and hilly lands southwards Pisa may be counted to the characteristic Mediterranean alliances *(Populion, Tamaricion parviflorae, Platanion, Lauro-Fraxinion)*.

As against plain-type sites, the riverine forests of the mountainous country show a rather uniform picture in whole Italy. The brook-side alder forests in mountains of medium height can be considered as belonging to *Aegopodio-Alnetum glutinosae*, those of high mountains to *Alnetum incanae*.

On the basis of literature and his own investigations, the author summarized the coenological and systematic relations of the riverine forests and shrub-storey communities of Italy as follows:

SALICETEA PURPUREAE Moor 58

SALICETALIA PURPUREAE Moor 58

I. Salicion triandrae Th. Müll.—S. Görs 58
1. *Salicetum triandrae albanicum* Kárp. 61
II. Salicion albae Soó (30 nomen nundum) 40
2. *Salicetum albae-fragilis* Issler 26
a) *myosotidetosum*
b) *cornetosum sanguinei*

QUERCO-FAGETEA Br.—Bl. et Vlieger 37

PRUNETALIA TX 52

III. Berberidion Br.—Bl. 50
3. *Hippophae-Salicetum incanae appenninicum* nov. ass.

FAGETALIA Pawl. 28

IV. Alno-Padion Knapp. 42 em. Mat. et Roz. 57
4. *Querco-Ulmetum italicum* nov. ass.
a) *populetosum albae*
V. Alnion glutinoso-incanae Oberd. 53
5. *Alnetum incanae* Aich. et Siegr. 30
6. *Aegopodio-Alnetum* Kárpáti V., I. et Jurko 61

POPULETALIA Br.—Bl. 30

VI. Populion albae Br.—Bl. 30
7. *Populetum albae occidenti mediterranicum* Kárp. 61
a) *normale*
b) *lauretosum*
8. *Alno-Fraxinetum angustifoliae* Kárp. 61
a) *normale*
b) *lauretosum*

TAMARICI-PLATANETEA ORIENTALIS NOV. CLASS

PLATANETALIA KNAPP 59

VII. Tamaricion parviflorae KÁRP. 61
9. *Tamarici-Salicetum purpureae* KÁRP. 61.
a) *normale*
b) *tamaricetosum gallicae*
10. *Nerio-Salicetum purpureae* KÁRP. 61
a) *normale*
b) *tamaricetosum africanae*
VIII. Platanion KÁRP. 61
11. *Platanetum orientalis balcanicum* KÁRP. 61
a) *normale*
IX. Lauro-Fraxinion KÁRP. 61
12. *Lauro-Fraxinetum angustifoliae* KÁRP. 61

SHRUBBY FORESTS OF CLEAR-CUT AREAS

X. Calystegion sepium TX. 47
13. *Amorpho-Rubetum nemorosi* KÁRP. 61
a) *lauretosum*

THE ROLE OF THE INTERACTION OF SUBSTRATE LEVEL AND PHENOLIC SUBSTANCES IN THE ACTION OF INDOLE-3-ACETIC ACID OXIDASE

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The interaction of the phenolic substances and the substrate level in the operation of indole-3-acetic acid oxidase (IAA oxidase) was investigated to gain a deeper understanding of the physiological role of the enzyme. The enzyme activity was measured manometrically and by paper chromatography in a reaction mixture containing 1 ml. enzyme extract, 1 ml. phosphate buffer (pH 6.3), 0.04 ml. manganic chloride, 0.5 ml. IAA and 0.5 ml. 2,4-dichlorophenol (DCP), all in various concentrations. Authors demonstrated that a diminution of IAA level led to an increase of the lag-phase length and a decrease of the activity. It was shown further that in the presence of a greater amount of DCP the lag-phase increases and the activity decreases, but with increasing substrate level the inhibition due to the addition of DCP may be eliminated. From this result it has been concluded that the IAA oxidase acts in the tissues only if the substrate level surpasses a definite value and in the presence of phenols larger amounts of IAA are required to activate the enzyme, therefore the endogenous auxin level rises.

STRUCTURAL FACTORS IN ANTIAUXINE EFFECT

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Abstract not received.

THE EFFECT OF PHENOLIC COMPOUNDS ON THE ACTIVITY OF INDOLEACETIC ACID OXIDASE

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To throw some light on the mechanism of action of some phenolic growth inhibitors, the presence of which was previously demonstrated in a number of plants, the role of phenolic compounds in the enzymatic oxidation of indoleacetic acid (IAA) was investigated. The experi-

ments were carried out with 15 monophenols, polyphenols and phenol derivatives, respectively, applied in a concentration range of 10^{-4} to 10^{-7} M. The enzyme preparation was made from 7-day old etiolated pea epicotyl by homogenization with M/20 phosphate buffer pH 6.1. The crude extract was centrifuged and dialysed for 24 hours. The activity of IAA-oxidase was measured photometrically and by paper chromatographic procedure. In both cases after incubation the residual IAA was estimated by the Salkowski reaction. The results indicate that the extent and nature of the effect of phenolic compounds on the IAA-oxidase depends on the type of the compounds applied. Monophenols (salicylic acid, p-oxybenzoic acid, m-oxybenzoic acid, o-coumaric acid and tyrosine) did not affect the activity of the IAA-oxidase system. By contrast, the polyphenols (ferulic acid, caffeic acid, DOPA, hydroquinone, pyrogallol, gallic acid and phloroglucine) inhibited the enzymatic oxidation of IAA. Maximum inhibition was found in the 10^{-4} to 10^{-5} M range; the extent of inhibition depended on the compound applied. Cinnamic acid and coumarin were found to be ineffective. The enzyme activity was greatly stimulated by vanillin. The activity of the enzyme and the effect on it of various phenolics depended on the substrate concentration as well. Increased amounts of IAA intensify the inhibitory effect of the polyphenols. On the basis of the results obtained it seems safe to conclude that the inhibitory activity on plant growth of naturally occurring phenolic compounds cannot be explained by their effect on IAA-oxidase. They apparently affect the growth processes by some other mechanism. On the contrary, the plant growth stimulating effect of some phenolic compounds can be brought in connection with their auxin sparing action

THE EFFECT OF NITROGEN SUPPLY ON THE ACTIVITY OF INDOLEACETIC ACID OXIDASE IN RICE ROOTS

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The root/shoot ratio is affected unfavourably by increasing concentrations of N supplied to rice plants grown in sand culture. The decrease in root growth apparently due to the accumulation of ammonia is particularly marked. Higher ammonia concentrations being toxic to the plant tissues, it might be assumed, that the enzymes involved in the control of root growth are also affected and this would explain, at least in part, the slower growth of the root system. In extracts from roots of rice plants supplied to a various dosage rate with ammoniumsulphate and potassiumnitrate the activity of indoleacetic acid oxidase was measured by means of colorimetric and paper chromatographic procedures. The effect of ammonium ions on the enzyme in vitro was also tested. It has been shown that increasing $(NH_4)_2SO_4$ and KNO_3 concentrations are associated with a proportionally decreasing enzyme activity. It is thus assumed that slow root growth in the presence of high ammonia concentrations might be partly due to abnormally increased auxin content. This idea was supported by the determination of indoleacetic acid level in the root system by paper chromatography and oat cylinder test.

STIMULATING INFLUENCE OF SMALL DOSAGE GAMMA IRRADIATION ON PLANT METABOLISM

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Upon the effect of small dosage (0.5 to 5.0 Kr) gamma irradiation (Co-60) considerable stimulation can be demonstrated in the ontogeny of plants. After irradiation of dehydrated seeds the phenological phases of plants are shortened, the physiological basis of which may be brought into correlation with the stimulation of metabolic processes. There is a 15 to 20 per cent increase in the dry matter under the effect of a small dosage gamma irradiation, particularly in the initial stages of the vegetative development. Stimulation of the intensity of metabolic processes is higher in the early developmental stages than later. The ion uptake capacity in legume seedlings, — which was irradiated with a small dosage in dehydrating state of seeds — increases two to five times in comparison with the control. The incorporation of $35\text{-}SO_4$

into the protein fraction of leaves increases by 50 to 120 per cent which is a symptom characteristic of the activity of metabolism intensity. The incorporation of 32-PO_4 into organic compounds is in the initial stages of vegetative development 2 to 3 times more rapid in the irradiated plants than in the control. The primary causes for the increase of metabolism intensity induced by a small dosage gamma irradiation consist in the rise of hydratation. In wheat varieties the rise of hydratation under the effect of small dosage irradiations ranges between 4 to 6 per cent, as consequence of which increase of mineral nutrition and the synthesis of organic matters ensue. The increase of metabolism intensity induced by small dosage irradiations is probably accompanied by a stimulation of cell respiration and by energy transfer processes.

DEVELOPMENT OF ROOT CELLS IN HYBRID MAIZE

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In a study on plant cell metabolism the rate of development of root cells in the maize hybrid (*Zea mays* Mv_1) employed in heterosis breeding and in parental plants used in hybridization were compared. The timing of developmental stages was carried out on the basis of distances of the respective zones from the root apex. The rate of development was characterized by determining the weight, total and nucleic acid phosphorus content, further total and protein nitrogen content of the cells.

Three clearly delimited zones could be distinguished in root apices of the plant studied. The first zone (from 0 to 3 mm) has the highest cell number but the cells are low in volume and weight. This may be considered as the division zone. In the 3 to 5 mm zone the cell number is approximately halved, with a 2—3 fold increase in cell volume and weight. This is the zone of cell growth. Still further from the apex (6 to 10 mm) the cell number is slowly but steadily decreasing with a parallel increase in volume and weight. In this zone tissue differentiation starts while cells still continue to grow. Between 10 and 15 mm cell growth and increase in weight are very slow.

There is an increase of total and nucleic acid phosphorus further of total and protein nitrogen content per cell up to 10 mm, *i. e.* up to the zone of differentiation. At greater distances from the apex all these values show a decrease. Marked increase in nucleic acid phosphorus and protein nitrogen content can be found only in the zones of cell division and growth. The relation of protein nitrogen and nucleic acid phosphorus can be taken as an index of cell growth and development. The DNA-P content of each cell attains a value several times higher than in the first zone. This great increase can hardly be explained by nuclear growth exclusively. A similar trend but different intensity of accumulation of substances was found in parental organisms. A careful evaluation of the present results may supply a valuable contribution to the cytological basis of heterosis plant breeding.

AN EXPERIMENTAL RESEARCH STUDY ON THE RELATIONSHIP BETWEEN TEMPERATURE AND VELOCITY OF GASTRIC DIGESTION IN PREDATORY FISHES

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In a comparative study we investigated the changes in time and space of gastric digestion in *Lucioperca lucioperca* L., *Perca fluviatilis* L., *Micropterus salmoides* Lacépede and *Silurus glanis* L., between 5° C and 25° C. The experiments were performed using vessels with running water and kept at constant temperature (±0.2° C). Natural food (generally: bleak, *Alburnus alburnus* L.; for *Silurus :* stickleback, *Acerina cernua* L.) was brought into the stomach by stuffing. The process of gastric digestion and the time passage of food into the intestines has been observed with an X-ray method earlier described. Time of gastric digestion in each experiment was expressed in percentage of the value at 5° C. The following values were obtained for *Lucioperca lucioperca :* at 10° C — 61%, at 15° C — 32%, at 20° C — 18%, at 25° C — 11%; for *Perca fluviatilis :* at 10° C — 51%, at 15° C — 43%, at 20° C — 24%, at 25° C — 18%; for *Micropterus salmoides :* at 10° — 46%, at 15° C — 34%, at 20° C — 22%, at 25° C — 17%;

for *Silurus glanis* : at 10° C — 42%, at 15° C — 24%, at 20° C — 14%, at 25° C — 10%. The increase of temperature between 5—25° C causes thus the greatest increase of digestion intensity in *Silurus*, the slightest one — in *Perca fluviatilis*. The intensity increase in *Silurus* and *Micropterus salmoides* is considerable, especially between 5 and 10° C. Comparing the speed of gastric digestion we can state that *Silurus* and *Lucioperca lucioperca* accomplish digestion at 25° C ten times, *Micropterus salmoides* and *Perca fluviatilis* 5—6 times more rapidly than at 5° C. The differences observed in gastric digestion can be explained besides chemical factors with great differences of the motion of gastric content. In the case of the two species *(Silurus glanis* and *Micropterus salmoides)* the more intensive gastric digestion parallel with temperature, can be traced back, besides enzyme kinetics, to mechanical factors.

EVALUATION OF GASTRIC DIGESTION STUDIES ON PREDATORY FISHES FROM THE ANGLE OF ENZYME KINETICS

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The well-known data of comparative physiology concerning the peptic digestion of proteins in the stomach of predatory fishes made it probable that a simple relationship between ferments and temperature might be disclosed on the basis of established empirical data (MOLNÁR and TÖLG) notwithstanding the complexity of the process. Plotting the reciprocal values of the absolute temperature against the natural logarithms of the reciprocal values of the digestion time a surprisingly good linear regression is received. This fact has been statistically tested for four or five points. The temperature dependent changes of gastric digestion in predatory fishes follow the Arrhenius equation. The given calculations are not influenced by the problem of CROZIER'S theory either, as a linear trend could be shown within a relatively wide thermical interval. The following constants were calculated: *Micropterus salmoides* LACÉPEDE = 12,000 g cal, *Perca fluviatilis* L. = 13,000 g cal, *Silurus glanis* L. = 18,000 g cal, *Lucioperca lucioperca* L. = 20,000 g cal.

At about 5° C, the statistical tests have shown a deviation from the Arrhenius equation. The gastric digestion in predatory fishes in water of 5° C is very slow. Notwithstanding the greater abundance of food for predatory fishes in winter, the metabolic processes in poikilothermic animals are inevitably controlled by the external temperature, affecting the rates of enzymatic processes.

STUDIES ON THE NEUROENDOCRINE CONTROL OF COLOUR ADAPTATION IN CRAYFISHES *ASTACUS* (DECAPODA)

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Investigations were carried out in order to obtain more complete comparative knowledge on the importance of the neuroendocrine regulatory mechanism of the colour change in the variously differentiated groups of the class Crustacea. Differently varied light-experiments with illuminated (1000 Lux) and totally darkened dishes were applied. In the experiments normal specimens with ligated resp. extirpated eyestalks and normal ones were used. From the supraesophageal and infraesophageal ganglia, postesophageal commissure, eyestalks, etc. extracts were prepared with water, ethanol and buthanol, and applied in *in vitro* test experiments using isolated chromatophores. The separation of the different factors was carried out by paper chromatography and paper electrophoresis. Simultaneously also histological controls were applied. In the case of *Astacus leptodactylus* and *Astacus astacus* a definite colour adaptation to the changes of illumination was found, but the changes of colour were contrasting. The colour change plays first of all a part in the filtration of the light during the moulting period. The active substances regulating these processes are polypeptid-like. The isoxanthopterin isolated from the brain showed also a strong erythrophorotropic activity. The strongest chromatophorotropic activity was observed in the eyestalks and infraesophageal ganglia. The hormones (isolated RC-, RC'- and BD substances) are produced continuously in the A and B type of secretory cells of the eyestalk and of different ganglia. The release of these substances

into the blood takes place directly on the surfaces of the ganglia. The granular resp. hyaline cells play an important role in the transport of these substances into the hemolymph. The RC substance, described by us, may be identical with KNOWLES' A' substance in *Leander*. In the case of *Astacus leptodactylus* the adaptation to illumination is slower than that to darkness. It is supposed that light adaptation in contrast to adaptation to the dark is controlled by factors constantly present in the hemolymph.

A REVISION OF THE PELVIC SEROSA DUPLICATURES

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Abstract not received.

APPLICATION OF AMMONIUM SULPHATE AGAINST THE PESTS OF RICE-PLANTS

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In 1961 laboratory examinations were carried out to study the control of the species *(Triops cancriformis, Leptestheria dahalacensis, Branchinecta)* injurious to rice plants by substances not inhibiting the growth of the plants. These investigations revealed that significantly higher yields were obtained by the application of ammonium sulphate than by other chemical products (DDT, HCH, copper sulphate, chloride of lime) employed earlier by rice-growers. With reference to the laboratory results, in the same year, the effect of ammonium sulphate on the above pests was studied also under field conditions in the state-farms at Gencshát and Palé. The results of these experiments, with proper control, are summarized as follows.

The ammonium sulphate exerting a significantly toxic effect — even under field conditions — on the aquatic species *(T. cancriformis, L. dahalacensis)* injurious to the young rice-plants, is also instrumental in the initial development of the plant. The growth of the rice-plants upon ammonium sulphate top-dressing is quicker, more vigorous and the yield is considerably higher (100 kg of ammonium sulphate resulted in 260 kg surplus yield per cadastral acre (Hungarian: hold = 0.57 ha)).

The fertilizer should be applied in small depth (5—10 cm) when the young *T. cancriformis* appear. This occurs about 10—12 days following the first submergence. When using 200 kg of ammonium sulphate per cadastral acre at this time the floodwater may be freed of the injurious pests. Later when the *T. cancriformis* are developed, higher quantities of the fertilizer (250—300 kg/cad. acre) are needed as the resistance of the species is increasing with development.

On the evidence of these experiments I suggest that the rice-growing state-farms — in order to check the pests of the rice fields and possibly to secure average yields — should apply the ammonium sulphate as N-top dressing instead of N-basic dressing.

Finally I wish to point out that the casting of the ammonium sulphate, at present, involves serious difficulties. Since handcasting needs considerable manpower and is extremely hard to carry out. Particular difficulties arise in cool, rainy weather. Hence the problem to be solved is to find out and establish a technique rendering the application of fertilizers easier and less expensive.

RESULTS OF BAT BANDING IN HUNGARY

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The author, working in the Hungarian Natural History Museum, set out to bat banding in 1951. By now the number of species banded is 17, and the total number of animals 22,300. These were marked on about 141 trips to 20 localities. Banding was performed with the so-called German form of band. The paper summarizes the results of experiences on methodics, *i. e.* the diameter of the bands applied, the season of banding — winter being preferred to

summer — the age of the animals, etc. The species most frequently met and examined are; *Rhinolophus euryale* BLASIUS, *Myotis myotis* BORKHAUSEN, *Myotis oxygnathus* MONTICELLI, *Miniopterus schreibersi* KUHL. Data obtained on local populations give a picture of different aspects of the life-cycle and other problems, *i. e.* attachment to locality, mortality, sex ratio and its changes, life-span, facts concerning reproduction, etc. Bats recaptured at certain distances from the banding-place made it possible to draw conclusions on regularities in the migration of some of the species and their distribution in Hungary.

PHYLOGENETIC AND TAXONOMIC RESULTS OF A COMPARATIVE ANATOMICAL STUDY ON THE CENTRAL NERVOUS SYSTEM IN ORTHOPTERA

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Abstract not received.

ON THE CAUSES OF THE COLLAPSE OF THE MALACOSOMA NEUSTRIA L. GRADATION IN HUNGARY

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The Lackey Moth ranges in the whole Palearctic Region, except the Polar areas. The heaviest damages are caused in the Northern Hemisphere. Its mass occurrences are confined every 6—10 years to certain regions of Europe, but often to extensive areas. In the oak zone of the South European countries, in the western parts of Bulgaria and Roumania, in the Don and North Caucasian districts of the Soviet Union, it causes smaller or greater gradations almost annually. The first known gradation occurred in Thuringia in 1776. The mass proliferation in Hungary began in 1955, continuing for 2—4 years in the same place but spreading annually and creating fresh pest centers, collapsing finally in 1959. Our observations were made in Révleányvár and Györgytarló, partly by systematic local studies and surveys, partly by laboratory breedings. It was found that, in the collapse of the gradation, climatic conditions are much less involved than in its development. If no intervention occurs, the collapse is primarily effected by virus diseases following a general weakening and degenerating disposition (80 per cent in Györgytarló). A considerable percentage of the surviving caterpillars are then annihilated mainly by parasite flies and to a more limited extent by parasite wasps. In Györgytarló, 69 per cent of the surviving larvae and pupae yielded parasite flies, and only 8 per cent wasps. The marginal spraying of insecticides in Révleányvár entirely prevented virus infections. The gradation here was brought to an end by the mass occurrence of Tachinids and a considerably smaller number of parasite wasps. 76 per cent of the caterpillars and pupae introduced in 1958 yielded parasite flies, and 5 per cent wasps. The decreased rate of feeding caused also a strong reduction in the number of eggs. In Györgytarló, the average 280 eggs dropped to 126. Subsequently to the collapse, eggs were definitively destroyed by egg parasites. They emerged from 90—98 per cent of the eggs bred in the laboratory, again asserting their considerable help in restraining the egg-stock of insect pests. Of the climatic factors, the destructive influence of only the cold rains and late frosts at the time of the hatching or first moulting of the larvae were observed. The final collapse of the gradation in Hungary was caused by the concurrent effects of the above factors.

THE MANIFESTATION OF THE INSTINCTS OF CARE AND SURVIVAL IN THE CASES OF NEST DAMAGES OF REMIZ PENDULINUS

P. BERETZK

SZEGED

The strongly developed instinct of care for its youngs of the Penduline Tit is well-known. It is a confident bird, well tolerating the proximity of man. During the breeding period, it continues feeding the fledgelings even in nests removed to a considerable distance from its original site of nidification. It feeds the chipping youngs even if the nest is hold in one's hands.

In nests collected for research purposes after incubation, I have often found addle eggs and mummified fledgelings. I explained the cause of death observed in the impaired nests by the destruction of the parent birds.

In the spring of 1961, I observed that a pair built and occupied a fresh nest in the immediate vicinity of a former, wholly completed one. Studying the phenomenon, I found the reasons for the birds' behaviour. The prolonged spring rains had entirely drenched the nest-Having soaked through, the tube of the nest flattened and made any communication through it impossible. This also explained the cause of destruction found in some nests, as well as the presence of circular openings in the wall above the tubes. Such nests were empty. My assumption was that, during the heavy rains, the parent birds were confined to the nest with no way of escape. Its instinct of survival compelled the bird to "break through" the wall. By this opening, the bird continued feeding its youngs. There were no apertures made in nests containing dead birds; evidently the parents have been outside when the tube collapsed. One might conclude that the instinct of survival surpasses the other strongly developed instinct of caring for the fledgelings.

In cases where small nests were built with no tubes, for want of building materials, no destruction was found.

In the Szeged-Fehértó Reservation, the Penduline Tit uses exclusively the indumentum of the spikes on the reed mace *(Typha* spp.) for building material. I have no information on the drenching of injuries of nests made of various willow of poplar indumentums. Experimental observations were needed to substantiate my assumptions.

AORTITIS IN OLD AGE

EDIT BEREGI, Z. BRASCH and J. SIMON

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Authors examined the organs of 73 cadavers over 65 years and those of control cases between 20—40 years. Out of the 73 post-mortem examinations aortitis was found in 31 cases. Only in 4 cases could be established a connection between aortitis and syphilis. In 3 cases pericarditis, in 6 cases myocarditis and in 4 cases inflammatory alterations of the art. pulmonalis were also observed beside aortitis. Thus, in 13 cases inflammatory alterations were found also in other organs; from these findings the cases are thought to be of rheumatic origin. In the remaining 14 cases only the inflammation of the aorta was established without syphilitic anamnesis; in these cases various inflammatory diseases (such as pyelonephritis, bronchopneumony, etc.) are thought to be the cause of the aortitis observed.

PATHOLOGIC CHANGES IN THE JOINTS OF WORKERS EMPLOYED IN THE HEAVY INDUSTRIES

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According to observations made in this Hospital, about two thirds of the complaints concerning the organs of movement are of articular origin. Pains due to arthrosis, and the consequential limitation of movements, mean a considerable physical and mental damage for the workers and impair their efficiency to a high degree. It is, therefore, an important task of medical science to elucidate the pathogenesis and aetiology of articular diseases, and to develop the most efficaceous therapy. Degeneration of the joints in the limbs, which is developing with advancing age, has been found to make a more rapid progress in workers of the heavy industries and in miners than in those working in other conditions. The resistance of the cartilaginous layer of the joints may be reduced by certain diseases. Static changes of the lower extremities (working boots), and special features of the place of work are additional factors in this connection.

The microclimate of the plant, its inner milieu, may produce quite serious effects upon the cartilages either directly or via the vascular and nervous paths.

Conditions of the workers' home, the general conditions of public hygiene, conditions prevailing transportation to and from the place of work, and — last not least — the general standard of life are all factors which either promote or retard the degeneration of cartilages. Processes of degeneration and their sequelae as concomitants of senescence are physiological phenomena. Only the knowledge of all factors involved enables the physician to inhibit arthritic diseases or, at least, to defer their appearance and so prevent much complaint and avoid much loss of work.

DATA TO THE AB0 BLOOD GROUP DISTRIBUTION OF THE POPULATION IN THE COUNTY OF VAS

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The blood group distribution in the population of a given area is regarded as one of the biological characteristics of the ethnic group living in that territory. Concerning the blood-donors living in the area of Western Hungary under study, István (1958), Backhausz and Nemeskéri (1960) published research data. The present researchwork conducted and elaborated by anthropological methods, should supply data for ethnic anthropology. Though our materials are drawn from the blood group determinations gained during the local blood-takings in the county Vas by the National Blood Bank Subcenter, Szombathely, in 1960—61, only those born in this county were considered in our evaluations. Their total number was 3190 (1.5% of the population of the county Vas). The persons examined were 18 to 60 years old, voluntary donors (men and women); no selection according to blood groups has been applied. Blood used for group determinations was always drawn from the ulnar vein. Since we made laboratory blood group determinations, the native blood sample to be examined was centrifuged, the red corpuscles brought together with 0, A, B, "Human" sera, and its serum with 0, A, B red corpuscle suspension produced by ourselves. For the mathematical treatment of the material, we applied Fisher's method. The blood group distribution of the material under study was as follows: "0"(I) 32.88%; "A" (II) 41.85%; "B" (III) 16.99%; and "AB" (IV.) 8.28%. — We have also examined, for the ethnic groups living in some smaller regional units of the county Vas, the frequency of occurrence as related to each other of the several blood groups. We have studied eight such regional units, namely: Kemenesalja, Kemeneshát, Hegyhát, Őrség, the neighbourhood of Szentgotthárd, Vasi völgység, Kőszeg hegyalja, Csepreg—Bük. In this order of sequence, from East to West, we experienced a considerable increase of the rate of the "0" group, almost concurrently with the moderate but definite decrease of the rate of the group "A". The ratio of occurrence as related to each other of the values of blood groups "B" and "AB" is inverse. The centrally situated Vasi völgység, supplying one-third of all examinations, approaches most closely the average frequency-distribution of the population studied. This is also substantiated by the values of the p and q factors, expressing gene frequency. The present investigations will serve as a preliminary basis for a more thorough sero-anthropological study, extending to several blood group systems, of the population of the county Vas.

ANTHROPOLOGY OF BALÁSTYA AND ITS SURROUNDINGS

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Abstract not received.

TESTER STUDIES IN "BARKÓ" VILLAGES IN COUNTY GÖMÖR

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Abstract not received.

BODY HEIGHT, CHEST BREADTH AND BODY WEIGHT OF SCHOOLCHILDREN OF HAJDÚSÁMSON IN THE YEARS 1951 AND 1961

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All schoolchildren of the primary school in Hajdúsámson were examined by the author in the years 1951 and 1961. The total number of cases amounted to 377 boys and 342 girls in 1951 and to 400 boys and 413 girls in 1961 respectively. Measurements of body height and body weight were carried out at the two tests. Comparing the mean values of the two tests the results were as follows:

The averages regarding both body height and body weight exhibit an increasing trend with both sexes. In 1961 some reduction was recorded in the averages of the chest breadth with children of both sexes but only till the age of ten years.

It was generally found that the values of the change — whether positive or negative — in all three characteristics are much smaller at the age of 6—10 years than at the age of 11—14 years. The augmentation is generally the largest at the age of 13 and 14 years.

According to the 1951 data the schoolchildren of Hajdúsámson were stunted mainly as to body height and body weight as against the average of the country. The peak of the lag fell on the age of 13 and 14. In 1961 the mean values of all ages corresponded to the average of the country. This is the explanation for the difference between the data of the two tests to be found first of all in the age of 13 and 14 years. The data of the chest breadth in the year 1951 approached more the average of the country than those of the body height and weight. Thus it is easy to understand that some reduction occurred in earlier years perhaps to compensate growth.

Investigating the environmental factors a considerable improvement was found. The financial situation of the parents became stabilized. The incomes ensuring higher and safer living standards to the families resulted in advantageous changes in the conditions of the children that exerted presumably a favourable influence on their physical development.

RADIOLOGICAL CRANIOMETRY OF THE UPPER FACE

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Although there exist more than a hundred methods for the craniometric evaluation of the radiograms taken of the skull in the lateral view, not even the most frequently employed methods have been compared or analysed as yet. A hundred radiograms of the skull have been investigated in the present study.

Longitudinal studies should always be referred to the surface determined by the interior aspect of the anterior scale of the skull, since the size of this surface shows no further changes after the seventh year of life (reference surface of DE COSTER).

Lines and angles, as defined by craniometric points are not accurate, because the points in question cannot be determined with complete precision. The standard deviations in respect of the individual craniometric points have been ascertained as follows (in mm): Nasion: 1.1; Basion: 6.0; Porion: 2.6; Nasospinale: 1.0; Orbitale inferior: 2.5; Prosthion: 1.1; Dentale superior: 1.2; Dentale inferior: 1.1; Gnathion: 2.6; Sella lower: 2.8; Sella middle: 3.0; Auriculare: 2.0; Bolton point: 3.1. Standard deviation of the Faciale angle: 4.0°; Mandibular angle: 7.3°; Clivus angle: 9.2°. The standard deviations of the lines which connect inaccurately determined craniometric points must obviously be likewise considerable: that in respect of the Length of the Base of the skull is 5.8 mm.; in respect of the Height of the Base of the skull (vertical projection of the Nasion-Basion distance) 8.6 mm.; in respect of the line between the lower point of Sella and Basion, parallel to the Frankfort horizontal plane (Sella-Base height) 15.3 mm.

It follows that all methods which adopt the Basion as one of the standard points of the measurement *i. e.* according to which

the Clivus angle = 130 − 0.6 *Cranial base length* ;

the Cranial base index = $100 \times \frac{height}{length}$ *of the Cranial base* ;

the PANKOW'S *index* = Sella-base distance = 0.45 *Cranial base length* — 1.36

are less reliable. The method of MALÁN and REHÁK which compare the linear facial measurements with reference to the distance between inferior orbitale and porion seems to be satisfactory.

ZUR STELLUNG VON OREOPITHECUS BAMBOLII GERVAIS INNERHALB DES HOMINOIDENSYSTEMS

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Oreopithecus bambolii wurde 1872 von GERVAIS als in der Nähe der Cercopithecoidea und anderer nichthominoider Katarrhinen stehend beschrieben, 1915 von SCHWALBE zu den fossilen Pongiden gerechnet. HÜRZELER, der das Oreopithecinenproblem erneut aufgriff, ordnete 1954 die Oreopithecinen den Hominidae zu. HEBERER und KÄLIN folgten diesen Schritt mit dem Unterschied, daß bei KÄLIN die Oreopithecusgruppe eine Familie, bei HEBERER eine Subfamilie im Hominoidensystem darstellt.

Im Referat werden die Möglichkeiten der phylogenetischen Einordnung von *Oreopithecus* nach dem zur Verfügung stehenden Fundmaterial diskutiert. Die Auffassungen REMANES und v. KOENIGSWALDS, die den Einordnungsversuch HÜRZELERS ablehnen, werden ebenso wie die zustimmenden Stellungnahmen HEBERERS und KURTHS besprochen. Gegen die Überbewertung bestimmter Einzelmerkmale von Zahnstrukturen hinsichtlich genetischer Einstufungen werden Bedenken geltend gemacht. Auf die Fragwürdigkeit des Ausschlusses von Vertretern fossiler Formgruppen aus der Vorfahrenreihe der Hominiden lediglich auf Grund stark variabler Merkmale bzw. von Merkmalen, deren Variabilität nicht bekannt ist, wird hingewiesen (Plastizität der Typen, Möglichkeit von lokalen Varianten). Der Meinung HEBERERS, daß der von ihm geprägte Begriff »Praehomininae« nicht auf die Oreopithecinen anwendbar ist, wird beigepflichtet. *Oreopithecus* repräsentiert innerhalb der Hominidenentwicklung nicht die »mittlere Linie«, sondern verkörpert eine Eigenlinie. Ihre Abtrennung dürfte im Obermiozän erfolgt sein.

ANTHRACOTOMIC STUDIES ON CHARCOAL REMAINS FROM A POSTGLACIAL PALEOANTHROPIC SITE AT SÜMEG

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In 1960 the remains of a primitive fire-place were discovered near Sümeg (Western Hungary) at about 200 m. mean sea level. Systematic excavations by L. VÉRTES in June 1960, brought to the light a large number of flint implements, *i.e.* fragments of ground stone, as well as charcoals and other relicts. From the nature of the implements VÉRTES came to the conclusion that they were the remains of a shop where flint implements had been worked, while their shaping pointed to the Neolithicum. Since neither finished implements of polished stone, nor stone or earthenware vessels were to be found, the find did not supply a wholy satisfactory basis for archeological identification. Characteristic fossils (bones) were equally missing, so that it was supposed that the examination of the charcoal remains would possibly furnish more reliable data.

Part of the charcoal material was forwarded by L. VÉRTES to the present author for identification. The charcoals in question came from pits Nr. I. and III, and namely 5 lots from the 110, 150, 165 and 200—250 cm deep levels of pit I., and 2 lots from the 100—200 and 300 cm deep levels of pit III.

Each piece of charcoal has been examined in three planes, by means of the combined stereo-opak-microscopic method. A total of 200 pieces was investigated. As a result of the anthracotomic investigation 159 pieces of *Quercus sp. (Qu. robur* or *petraea)*, 12 p. of *Acer*

cf. pseudoplatanus, 4 p. of *Castanea* and 25 p. of *Fagus silvatica* remains could be identified. From among these categories *Quercus* was represented in all groups but one (pit Nr. I., 150 cm), *Acer* in three of them, (pit Nr. I., 110, 165 and 200 cm), *Castanea* in one (pit Nr. III., 300 cm) and finally *Fagus* also in one of them (pit nr. I., 200 cm).

Most remarkable are the four *Castanea* remains. Up to the present *Castanea* charcoals dating back to the postglacial age of Hungary were found but in two places. The first one has been identified by F. HOLLENDONNER in 1931, as originating from the Mesolithicum of Avas (near Miskolc). This finding caused surprise at that time since in the history of vegetation and also ecologically, the Neolithicum is the extreme possibility for the occurrence of *Castanea*. In 1940 P. GREGUSS reexamined HOLLENDONNER's data and was led to the assumption that they were not wholly justified, owing to the insufficient size of the charcol. According to GREGUSS the piece in question was the remain of *Quercus* sp. A conclusive difference between the two categories is the presence of wide rays in *Quercus* and their absence in *Castanea*. These rays being, however, widely spaced, one could cut out from *Quercus* too, a 2 to 3 mm piece, in which no large rays would be present. Later, in 1952, SÁRKÁNY and STIEBER discovered among the Bronze Age charcoals found in the lower cave at Remete (Budapest), one piece of *Castanea* accompanied by *Quercus*, *Acer*, *Fraxinus* and *Carpinus*. The *Castanea* charcoals recently investigated have tangential surfaces of 8 to 10×10 to 15 mm, containing no large rays at all, so that they can be identified with absolute certainty as *Castanea*.

The above mentioned categories point altogether to the beginnings of the postglacial beech-age. Data published by P. E. DAMON (Arizona) support this statement. Upon request of L. VÉRTES, MR. DAMON carried out ^{14}C-radiation examinations on a different lot of charcoals, as a result of which their age could be determined as being 2720 (±160) years B. C. Archeological data are in keeping with the above result, inasmuch as according to L. VÉRTES, the find dates back probably to the latest period of the Neolithicum, to the so-called aeneolithic culture. The occurrence of *Castanea* in this period is an important contribution in view of settling the long-disputed problem of the indigeneity of *Castanea* in Hungary.

ALLOMETRIC STUDIES ON SCULLS OF MAMMALS

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Abstract not received.

Abstracts of papers read at the sessions of the section B

EFFECT OF BETA-ALANINE AND GAMMA-AMINOBUTIRIC ACID ON LOCOMOTION AND POTASSIUM INDUCED REVERSAL IN PARAMECIUM

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In earlier studies an effect of acetylcholine and cholinesterase inhibitors has been demonstrated in *Paramecium multimicronucleatum*. If these depolarizing agents are used in concentrations not affecting the swimming speed of the animals, a marked increase of the duration of potassium induced reversal is observed. A study of agents having an opposite, *i. e.* hyperpolarizing action seemed also to be justified. In the present work *P. multimicronucleatum* was treated with β-alanine (BA) or with γ-aminobutiric acid (GABA). The swimming speed was determined with the photographic method of Dryl, the duration of excitation by measuring the length of the reversal induced by 0.0125 M potassium chloride. Low concentrations of BA (0.025 to 0.075 M) did not affect the swimming speed but produced a marked decrease of the duration of excitation. This finding is in good agreement with the assumption of a hyperpolarizing action of BA on the *Paramecium* cell membrane. GABA had a different action, *viz.* its low concentrations (0.025 M) elicited a strong depression of locomotion while the duration of excitation remained almost unchanged. Marked depression of excitation too was observed when somewhat higher concentrations (0.037 to 0.1 M) of GABA were applied. The results show apparently independent reactions of swimming and excitation in *Paramecium* to chemical effects. Further studies are necessary to disclose the similarities and differences in the excitative processes in nerve cells and ciliates.

ACID PHOSPHATASE AND NONSPECIFIC ESTERASE ACTIVITY OF FOOD VACUOLES IN AMOEBA PROTEUS

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Food vacuoles of *Amoeba proteus* fed with *Tetrahymena pyriformis* exhibit strong activity of acid phosphatase and nonspecific esterase which were demonstrated with simultaneous azo-coupling histochemical methods using alpha-naphthyl phosphate or alpha-naphthyl acetate as substrates. The activity of both enzymes follows a characteristic pattern during vacuole cycle. Food organisms in recently formed large vacuoles do not stain more intensely than uncaptured animals. The staining with both methods increases quickly after the vacuolar wall has adhered to the prey. The strong reaction is maintained over the whole existence of the digestive vacuole. The origin of increased activities is not in the prey but in the ameba. The demonstrated enzymes most probably take part in the intracellular breakdown of food. These findings together with recent data concerning food vacuole ultrastructure, justify us to regard ameba digestion vacuoles as belonging to lysosomes in the broad sense of the word.

IS THE RHYTHMIC ACTIVITY OF THE LARVAE (GLOCHIDIA) OF THE FRESHWATER MUSSEL (ANODONTA CYGNEA) MYOGENIC OR NEUROGENIC AS TO ITS ORIGIN?

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The rhythmic activity of the glochidia of mussels was observed a long time ago. Investigations of Herbers also revealed that glochidia possess neural structures. It has, however, been problematic and not investigated so far whether the rhythmic activity of these larvae

has a neurogenic basis, as in adult animals, or follows a myogenic rhythm. As the problem is essential in regard to the ontogeny of the mussels' rhythmic activity, the authors investigated the possibility of influencing this rhythmic activity by means of drugs affecting the neuromuscular transmission as well as inhibiting and exciting the neural elements. The effects of curare, hexamethonium, TMA, nicotine and strychnine were studied. In the first 1—2 minutes, all the test materials were found to increase the activity. Subsequently, however, they become ineffective and merely an insignificant level of activity as compared with the control can be observed. The authors suggest that the increase of activity recorded in the first minutes may be due to a general membrane effect rather than to any neural effect, and that it is produced directly in the muscular elements. The experimental results show that the muscle has no functional innervation yet despite the presence of certain neural elements. Consequently the rhythmic activity of glochidia is myogenic in its origin. Similarly no lasting increase of activity was produced by applying ACh. This fact also supports the myogenic origin of rhythmic activity, as the muscles of adult mussels being subject to nervous regulation are exceedingly sensitive to ACh.

SIGNIFICANCE OF SEROTONIN IN THE INHIBITORY MECHANISM OF THE POSTERIOR ADDUCTOR OF LAMELLIBRANCHIATES

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Division of the cerebrovisceral connective of the *Anodonta cygnea* is according to literature and the results of the author's experiments, followed by a lasting tonic contraction of the posterior adductor. Myography was used for the recording of processes occurring in the posterior adductor, and electrophysiological registration for the analysis of neural factors involved in the genesis and inhibition of tonicity. If the muscle and the visceral ganglion are exposed to the influence of serotonin, a durable alternation of phasic contractions and relaxations will follow. Finally the muscle completely worn out, reaches a phase of rest. Reflexogenic stimulations, originating in the mantles, provoke in this state of rest only tetanic contractions and relaxations without the reappearance of tonicity. It follows that serotonin is capable of completely inhibiting tonicity which would otherwise follow transection and is thus capable of — so to say — replacing the lack of ganglionic deficiency. The conclusion seems, thus, to be justified that — under physiological conditions of the cerebral ganglion — inhibitory effect on normal tonicity of the posterior adductor is mediated by serotonin.

A REFLEX MECHANISM CHANGING THE ACTIVITY IN GASTROPODS UPON OSMOTIC EFFECTS

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It is well-known that motion activity of pulmonata will increase under normal conditions when humidity of the environment increases. The changes of electrical activity of the central nervous system in *Arion empiricorum*, *Limax maximus*, and *Helix pomatia* have been studied when the peripherial osmoreceptors were stimulated. The activity of pedal and cerebral ganglions was registered by cathode-ray oscillography, while the osmoreceptors of the sole were stimulated by solutions of various concentrations and by water. It was found that bioelectrical activity of pedal and cerebral ganglions will change by peripherically applied osmotic stimulants, which is closely related with the increase of activity in the whole animal. The data obtained prove that the nerve centres of molluscs respond directly by reflexes to the changes in the humidity (osmotic conditions) of the environment. The author's findings contradict the statements of Kerkut, Taylor and Hughes who suggest that the increase of activity in pulmonata induced by the effect of humidity is exclusively due to changes of concentration in the hemolymph.

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

THE EFFECT OF PHENOTHIAZINES ON SOME INVERTEBRATE ANIMALS

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Phenothiazines are well-known as major tranquillants. Their effect has been thoroughly investigated in man, on various mammals and in isolated enzyme systems. Hence it seemed to be worth while to investigate briefly their activity on animals bearing a less specified, primitive nervous system, representing the beginning grades of phylogenesis. The activity of phenothiazines on various phyla were investigated by different methods, observing the inhibition of vital behaviour and characteristic responses. In hydromedusa chlorpromazine (0.1 mg/ml) and perphenazine (0.033 mg/ml) abolished the rhythmic movement reversibly for 15—20 min, whereas acetylcholine proved to be effectless. In *Actinia aequinea* perphenazine (5 mg) and promethazine (25 mg) diminish spontaneous reaction and feeding processes. *Hirudo medicinalis* became inert for 4—5 hours upon the same treatment. *Holothuria tubulosa* ceases spontaneous movements and defence responses to nociferous stimuli. *Holothuriae* became inert after treatment with 2.5 mg chlorpromazine or 5 mg perphenazine. With cephalopods *(Octopus vulgaris)* the vigorous defense reactions became diminished as an effect of 50 mg/kg chlorpromazine or 45 mg/kg perphenazine. On all animals the tranquillant effect was reversible and no changes in the vital processes of the organs have been observed. Owing to paramount differences between the simple invertebrates and the mammal nervous system, the obvious question arises as to the activity of phenothiazines. In mammals certain parts of the midbrain react principally to phenothiazines. In invertebrates however there is no similar structure. Another possibility is the selective inhibition of the neurons in general. We can assume that the physiological effects in the neurons are largely the same in higher and lower species, presenting thus similar reactive changes to phenothiazines in the neurons of an actiniae network as in the ganglionated nervous centres of the Octopoda and higher phylogenetical animal groups.

CONTRIBUTIONS TO THE NEURAL CONTROL OF NUCLEIC ACID METABOLISM IN SCELETAL MUSCLES OF BIRDS AND REPTILES

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A marked change in nucleic acid content due to interruption of peripheric innervation in mammalian sceletal muscles has been observed in our earlier studies. DNA content increased, while RNA content decreased in the denervated gastrocnemic muscle of rats. In the present work possible differences of neural control in nucleic acid metabolism of certain higher vertebrate classes (Amniota) were tested. Accordingly, the DNA and RNA metabolism in the striated muscle of different species was studied after interruption of neural control. A 10 mm length of the n. ischiadicus was extirpated and the nucleic acid content of denervated as well as of untreated contralateral muscle was ascertained in pigeon *(Columba domestica)* and turtle *(Emys orbicularis)*. In order to detect a possible role of inactivation, unilateral tenotomy was performed by partial extirpation of the achillean tendon in a separate group. The nucleic acid content of gastrocnemic (pigeon), gastrocnemic and femoral rectus (turtle) muscles was determined by ultraviolet spectrophotometry (Tsanev and Markov) and by biochemical (Schmidt and Thannhauser) methods on the 5th, 10th, 15th and 20th days. The results revealed the same trends of nucleic acid changes due to either effect during the experimental period as those observed in mammals. DNA metabolism, however, was less affected in the present work. A positive correlation was observed between the degree of changes in muscle nucleic acid content and the level of phylogenetical position of the species studied. In birds tenotomy elicited a greater atrophy as compared with denervation. The shifts in the nucleic acid content (mg per 100 mg tissue dry weight) were, however, always larger in the latter case. This observation also confirms the existence of a genuine trophic nervous effect assumed by the present authors.

EFFECT OF VITAMIN A ON THE NUCLEIC ACID METABOLISM OF RATS

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The growth-promoting effect of vitamin A is commonly known, but the mechanism of its action upon the intermediary metabolism has not been elucidated so far. As nucleic acid metabolism plays a significant role in cellular growth, the authors tried to establish interrelations between the mechanism of the vitamin A effect and the DNA and RNA balance of the organism.

In the first series of experiments adult rats were divided in two groups: members of the control group were kept on a diet free from vitamin A, while those of the test group received 1000 I. U. of vitamin A with their diet. The rats included in the second series were normally fed adult animals; the test animals received 1500 I. U. of vitamin A, while the food of the controls contained no such vitamin.

Vitamin A proved to affect the nucleic-acid metabolism in both test groups while its action varied from organ to organ. The level of DNA increased in the members of both test groups. This increase was perceptible in all examined organs (adrenal gland, kidney, liver, brain, skin, spleen) with exception of the heart. The difference between tests and controls was statistically significant in certain organs *e. g.* in the skin, spleen, kidney and adrenal. The fact that the level of DNA underwent but an insignificant change in the brain and heart is presumably due to that the decrease of DNA-content is a slower process in these vital organs, or, else, that the effect of vitamin A as administered in the experiments was too weak. As regards RNA, the increase of its amount in the skin, spleen, kidney and adrenal was statistically significant in both test groups. Increase of RNA content was less marked in the testis, heart and diaphragm, and practically nil in the intestines, liver and lungs.

The results of the present investigations justify the assumption that there are two mechanisms through which vitamin A affects nucleid-acid metabolism: (1) it may inhibit the reduction of the nucleic acid contents in certain organs, *i. e.* it inhibits a decomposition of both DNA and RNA in these organs; (2) it may promote the synthesis of nucleic acids.

THE ROLE OF INTRACELLULAR POTASSIUM IN THE MECHANISM OF THE SMOOTH MUSCLE FUNCTION

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Authors investigated on isolated ilea of rabbits and guinea-pigs in potassium-free organ bath the change of the reaction capacity of smooth muscle in the course of diminution of the intracellular potassium store. In potassium-free Tyrode solution the intestinal loops show an increased activity (Clark), and the smooth muscle organs lose potassium during functioning in proportion to their activity (Born and Bülbring). Consequently the continuous functioning in the potassium-free organ bath leads to a gradual diminution of the intracellular potassium store. It was found that, parallel with the process referred to, both spontaneous activity and capacity of reaction to chemical agents (acetylcholine, barium chloride, nicotine and histamine) of the gut at first increased, later decreased and finally ceased (exhaustion). Exhaustion on various chemical exciting substances does not ensue at the same time; for instance, the gut, which is refractory to nicotine because of serial stimuli, can be contracted even by acetylcholine of an equivalent effectivity to nicotine. Uptake of potassium by the cells (a process requiring energy), by incubation of the gut in organ bath containing a high level of potassium, glucose and insulin, resulted in the full restoration of intestinal function. Restitution is essentially uptake of potassium, because glucose and insulin, without potassium, do not result in restoration. Both gluco- and mineralocorticoids increase the leakage of potassium from the smooth muscle cells of isolated gut, and greatly hasten its exhaustion. On the basis of experimental results authors obtained two main conclusions: (1) The spontaneous activity and reaction capacity of the smooth muscle are decisively influenced, besides extracellular potassium concentration, by the majority of intracellular potassium store. (2) It is supposed that intracellular potassium level is controlled by insulin and adrenocortical hormones.

SOME PROBLEMS OF HUMORAL REGULATION OF LIVER REGENERATION

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In the course of liver regeneration elicited by partial hepatectomy — among others — two characteristic biochemical changes were observed: (1) a significant increase of serum mucoprotein level at the maximum of regeneration and (2) a shift of serum proteins to an increased ratio of α-globulins. In view of the fact that administration of serum from hepatectomized rats (HAS) induces histochemical changes in liver of normal animals similar to those observed during regeneration, a study of serum mucoproteins seemed to be reasonable in animals treated with HAS. Young male albino rats were treated with HAS (2 ml HAS every 3 days intraperitoneally). Appropriate controls were included in the experiments. Animals were exsanguinated on the 1th, 6th, 9th, 30th, 60th, 90th and 210st days. The mucoprotein content of serum from HAS-treated rats showed a great, statistically significant increase in the acute period. This shift soon disappeared and no difference was found between untreated animals and animals treated for 1 month. Administration of serum from untreated animals as well as sham-operation also produced a slight, but not significant increase of serum mucoprotein. For determining in which protein fraction the factor responsible for stimulation of liver regeneration is to be found the serum of partially hepatectomized rats was fractionated by preparative electrophoresis in four fractions (albumin + α_1-globulin, α_2-globulin, β-globulin and γ-globulin). The individual fractions were dialysed and concentrated and subsequently intraperitoneally administered to young normal rats. The mitotic index was determined in the liver 30 hours later. Significant increase was found in animals treated with the α_2-globulin, and in a lesser extent in animals treated with the albumin + α_1-globulin fractions. No similar effect was observed under the influence of other fractions or the serum of sham-operated controls. Present knowledge does not allow to decide on the chemical nature of the serum factor stimulating tissue regeneration. A detailed chemical and biological study of active α-globulin fractions subjected to further purification may give a reply.

STUDIES ON MICRO-DETERMINATION OF PROLACTIN WITH P^{32}

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BROWN *et al.* have shown an increased P^{32} uptake by pigeon crop glands under the effect of repeatedly administered prolactin. In our first experiments the P^{32} uptake was determined in animals treated according to the well known "4 day prolactin microtest". This resulted in elaborating a local test of higher sensitivity; the quantitative evaluation of the unilateral reaction, however, was rather subjective. Observations revealed an increased P^{32} uptake by the crop gland in the area of the intracutaneous administration of prolactin as compared with the contralateral control area. The increase observed amounted to some 100 per cent after administration of 0.25 I. U./day for 4 days. No effect was observed with a 12-times smaller dose (0.021 I. U./day for 4 days). Increased uptake was produced even by a single injection of prolactin (0.08 I. U./day). Accordingly, both the prolactin dose used in the test and the duration of the test may be diminished at least by a factor of 4 (*i. e.* the necessary dose is 0.08 I. U./day).

Prolactin elicited similar effects in vitro in the P^{32} uptake by crop glands. Pieces of excised glands, kept in Tyrode containing prolactin (0.005 I. U./ml) at 38° C for 4 hours, exhibited 25 to 50 per cent increase in the uptake as compared to control glands of similar size kept in three times weaker prolactin solution (0.0015 I. U./ml) or in Tyrode.

Studies are in progress aiming the establishment of a dose-response relationship in vivo and *in vitro.*

ADRENAL ZONE CONTROLLING MINERAL METABOLISM IN PIGEON

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According to many authors the mammalian adrenocortex may be divided into morphological zones as well as into physiological ones. Different zones produce accordingly different hormones. It is well known that bird adrenals have no zones, the cortical and medullary substances are not even separated. Author studied with histological methods the adrenals of 60 pigeons and found in certain cases traces of zonation in the interrenal cells, thus a functional differentiation of these cells could be assumed.

18 pigeons of both sexes were fed for one month on wheat grains impregnated with sodium chloride. Each animal thus incorporated 1 gr. NaCl daily. 12 animals served as control. No differences could be demonstrated in control animals as to the lipid content and nuclear diameter of peripheric and deeper interrenal cells. In salt-treated animals a strong reduction of lipid content was found in peripheric interrenal cells, accompanied by a 30 per cent average decrease of nuclear diameter. Deeper interrenal cells showed unchanged lipid content but increased nuclear diameter as compared with similarly situated cell strands in control glands.

Increased salt uptake accordingly induces a reduction of the peripheric and a certain hypertrophy of the deeper interrenal cells, *i. e.* similar changes are observed in avian and mammalian adrenals. Author assumes that peripheral interrenal cells produce aldosterone as does the zona glomerulosa of mammalian adrenal and that deeper cells produce glycocorticoids.

NEUROSECRETION OF THE NUCLEUS PRAEOPTICUS IN THE BULLFROG RANA ESCULENTA AS AFFECTED BY ENVIRONMENTAL FACTORS

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In seasonal and diurnal periodical investigations of life rhythm carried out in this Institute hitherto for the most part on homoiotherm animals, in the first place the change of the quality of light and the alternation of light and darkness respectively has been recognized as the synchronizer of rhythm. In the control of the periodical life processes in poikilotherm species presumably temperature is more instrumental. The combined effect of low (3 to 4° C) and high (20° C) temperatures respectively and of prolonged light and darkness on the endocrine organs of *Rana esculenta* was accordingly studied. In the present report the changes in the neurosecretory cells of the nucleus praeopticus were established with histophysiological methods. These cells of animals kept in cold and light are small; Nissl bodies and tiny vacuoles are seen between them at the margin of the cytoplasm. Upon the combined effect of heat and light the cells expand, there are few Nissl bodies and the cytoplasm is filled with tiny granules staining with chrome haematoxylin, which intrude also into the processes originating from the cells and at a distance from the cell merge into a mass of secretion. Cells filled with large drops of neurosecretion are frequent. In the tractus praeopticohypophyseus the transportation of the neurosecretion can be observed in the form of pearl string formations and large Herring-bodies. The neurosecretory cells of frogs kept in cold and darkness are full of coarse granules; larger and smaller vacuoles frequently occur. The cell processes are empty, the bead string formations rare, and small Herring bodies are found but occasionally. The animals kept in heat and prolonged darkness exhibit rather considerable individual differences as compared with the former three homogeneous groups. The neurosecretory cells are small and suggestive of exhausted cells. Intercellular, vacuolated masses of secretion are frequent and many vacuolated pearl string formations can be observed. Neurosecretion is accordingly inhibited by low temperatures, while high temperatures, particularly when combined with prolonged light, strongly stimulate both the formation of neurosecretion and its transportation into the posterior lobe of the hypophysis. The non-uniform response of animals kept in heat and darkness is explained by the fact that these two factors are never combined in the life of *Rana esculenta* under natural conditions. The cells after an increased activity are in the state of functional

exhaustion; this is also pointed to by the finding that the greatest amount of neurosecrete and Herring bodies are found in the neurohypophysis of these animals.

GOMORI-POSITIVE SECRETION IN THE EPENDYMA OF THE INFUNDIBULAR RECESS AND ITS RELATION TO THE HYPOPHYSEAL PORTAL VESSELS

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The subcommissural organ and the paraventricular organ are two so-called ependymal organs in the third ventricle. They produce a substance similar to the Gomori-positive neurosecretion which is emptied partly into the cerebrospinal fluid and proceeds partly the ependyma cell processes. In the present study of the infundibulum of different vertebrates it was found that there is also a special, cylindrical ependyma arranged in several rows, differing in structure from the surrounding epithelium and built like the ependymal organs. By staining with Gomori's chromalaunhaematoxylin-phloxin or with paraldehyde-fuchsin, Gomori-positive granules were observed in the cells. They were in abundance on the ventricle's surface of the organ. Granules were also found in the ependyma cell processes.

By means of the so-called "releasing factors" the hypothalamus controls the adenohypophysis and so the whole hormonal system of the organism by the portal blood circulation. Therefore it seems important that the above-mentioned ependyma cell processes, easy to follow up their short course, end around the portal vessels.

A great number of authors consider hypothalamical neurosecretion to be responsible for the "releasing" effect. Our present investigation demonstrating the appearance of infundibular ependymal secretion bearing a narrow relation to the portal vessels, attract attention besides neurosecretion to the ependyma and the secretion of the latter.

HORMONAL INFLUENCES IN CELLULAR DEFENSE MECHANISMS

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Earlier experiments of the authors led to the conclusion that individual organs of the lymphatic system have different functions. In spite of a certain overlapping certain functions are characteristics of the thymus gland, while others characterize the lymph nodes and the spleen. The lymphatic system composed of these parts may reflect the activity of two different defense mechanisms. Disturbances in tissue correlation (*e. g.* gravidity, malignant growth or regeneration) provoke a local or general increase of mast cells, whereas the presence of foreign proteins is reflected by increase of plasma cells.

In the present work the reactivity of the organism was experimentally shifted in either of the two possible directions and subsequently the effect of this shift on the opposite reaction was tested. Rats were treated with cortisone after immunization with egg albumin. Control groups received only one of the treatments. A plasmacellular reaction in lymph organs of immunized animals clearly showed the effectiveness of this treatment in provoking a shift toward the dominance of plasmacellular response.

Histological studies on thymus glands of cortisone treated animals revealed epithelial reaction and frequent appearance of secretum filled cysts, further an intense evacuation of thymocytes and a strong increase and subsequent destruction of mast cells. Previous immunization changed the cortisone effect. In this case a characteristic epithelial reaction was still found but evacuation and mast cell reactions were minimal. As an elevation of serum acid mucopolysaccharide level is known to accompany the increase and destruction of mast cells, this level was also determined in the different groups and was found to decrease after immunization and to increase after cortisone treatment. No effect of cortisone on the serum mucopolysaccharide level was observed in immunized animals. These findings are in good agreement with the histological observations and support the assumption of the present authors that the defense mechanisms of the organism, when shifted to a certain direction, can give no or only slight responses to provocative agents acting in opposite direction.

CHEMICAL EFFECTS INFLUENCING STERIC STRUCTURE AND BIOLOGICAL ACTIVITY OF PROTEINS

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Abstract not received

ROLE OF HYDROPHOBIC GROUPS IN ENZYMATIC ACTIVITY

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Abstract not received.

THE HETEROGENEITY OF AMINO ACID POOL IN PANCREAS PROTEIN SYNTHESIS

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In earlier investigations from this laboratory it has been observed that in pigeon pancreas slices the labeling of amylase showed a lag period of several minutes. In the present experiments the possibility was tested whether this phenomenon is due to the relatively low rate of exchange of the free amino acid pool of slices. Pigeon pancreas slices were incubated in a Krebs bicarbonate solution under aerobic conditions in the presence of glucose and a synthetic amino acid mixture at 37° C. The medium contained glycine-1-^{14}C in a concentration equal to the glycine content of the tissue pool, *i. e.* 2 μM/ml medium. At various experimental times amylase was isolated from one part of the slices according to STRAUB's micro method and the specific radioactivity of the enzyme was measured. The rest of the properly washed slices was homogenized in $HClO_4$ and subsequently centrifuged. The supernatants were neutralized with KOH and then subjected to an amino acid separation on an ion exchanger (Amberlite IR 120) according to the method of STEIN and MOORE. The specific radioactivities of the amino acid fractions were determined. The glycine exchange between the free amino acid pool and medium is a rapid process, its rate decreased, however, slightly after the first minutes. Specific radioactivity of the pool glycine plotted against time was similar to a saturation curve. Of the other amino acid fractions radioactivity could be detected only in serine, but this activity did not exceed more than 1/10—1/7 part of the pool radioactivity after 20 minutes. Accordingly the specific radioactivity values of amylase could be corrected and the relative specific activities *i. e.* $\frac{c.p.m/\mu M \text{ glycine in amylase}}{c.p.m/\mu M \text{ glycine in pool}}$ were calculated. The time curve of the relative specific radioactivities gave a straight line, its calculated 0 value corresponded to 5 minutes incubation time. It follows that kinetics of amino acid exchange between pool and medium and incorporation into amylase were different, no direct correlation existing between these two processes. The existence of a second pool has to be assumed that contains the amino acids in a bound form available for amylase synthesis.

PREPARATION OF CHOLINESTERASE-ACTIVE FRACTION FROM CATFISH MUSCLE

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Authors reported previously that myosin preparations obtained from the sceletal muscle of catfish according to Hamoir showed a specific activity of 8—10 mg Ach/mg protein/hour. In ultracentrifuge, however, two components (one 3 S and another 6.5 S) were recorded. A method was elobarated by the present authors to separate the two components. The homogenizate of the muscle was extracted by two volumes of 0.2 M $MgCl_2$ solution at pH 6—6.5 and 0° C for ten minutes. The ionic strength of the extraction was reduced by adding 11 vol. H_2O, and the separated precipitate dissolved at ionic strength of 0.6 μ by adding 3.86 M of $MgCl_2$ solution. The preparation was centrifuged in a MSE centrifuge at 40—50 000 g. Reducing the ionic strength of the supernatant to 0.25 μ the settled precipitate was removed in MSE centrifuge. In the next step, the ionic strength of the supernatant was reduced to 0.05 μ and the precipitate obtained solved in 0.6 M of KCl at pH 7. In the ultracentrifuge this preparation did not prove yet to be homogeneous. Further purification was carried out by diminishing the pH to 4.5. A great part of the solved protein was precipitated and partly denaturated at pH 4.5. After a standstill for 15 minutes pH was adjusted to 7, then the denaturated and unsolved protein was removed by centrifugation. The supernatant is pellucid, and shows a sedimentation coefficient of 3—3,3 S; its cholinesterase activity is 18—22 mg Ach/mg protein/hour.

STUDIES ON AMINO ACID AND PURINE METABOLISM IN NORMAL AND MALIGNANT CELL CULTURES

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Having found that in tissue cultures normal and malignant cells differ in their sensitivity to certain drugs we attempted to establish the metabolic differences between them. The cells used for comparing amino acid and purine metabolism were myoblasts obtained by trypsinization of the skeletal muscle of 12-day chick embryos, ENG sarcoma and Ehrlich—Lettré carcinoma ascites cells of the mouse. Normal and tumour cells were incubated in flasks in medium-199 at 37° C for 5 and 2 days, respectively. Changes in once "used" culturemedia were then analysed by paper chromatography with ninhydrin and isatin for amino acids, and Wood- and dichromate reagents for purine bases. Myoblasts showed a regular and intact morphology, and an increased uptake of nutrients when the medium had been supplemented with 0.6% polyvinyl-pyrrolidone. Cystine, alanine, valine, phenylalanine and isoleucine were taken up at the same rate by all types of cells. Tumour cells showed a preference for arginine and glutamine, whereas normal cells for aspartic acid, glutamic acid and methionine. Proline was incorporated by all the cell types but particularly by the Ehrlich cells. Some contradiction seemed to exist among different cell types in the utilization of certain amino acids. The amount of hydroxyproline decreased in the medium of myoblasts and of Ehrlich cells; conversely, it increased in that of sarcoma cells; alanine was released by malignant, whereas taken up by normal, cells. As to the purines, adenine has been utilized completely by tumour cells but only partially by normal cells. At the same time, hypoxanthine has appeared in the latter's medium, and another component, as yet unidentified, has been released by malignant cells. The differences observed are, in our opinion, not tumour-specific.

CHANGE OF MEGAKARYOCYTE FUNCTION IN PATHOLOGIC CONDITIONS

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Abstract not received.

DESOXYRIBONUCLEOPROTEID CONTENT OF PERIPHERAL ERYTHROCYTES IN AMPHIBIA

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Authors report on the first results of a quantitative cytochemical study on blood and haemopoetic organs. Erythrocytes of peripheral blood from several amphibian species *(Amblystoma mexicanum, Pleurodeles waltlii, Rana esculenta* and *Xenopus leavis)* were studied. Blood was drawn without using an anticoagulant. The erythrocytes were washed in physiological saline. Smears were prepared from washed blood cells and from pleurodeles liver and stained with Feulgen and ninhydrin-Schiff reactions. Quantitative determinations were performed in a histophotometer at 560 mμ.

Results show (1) that erythrocytes of the species studied contain a diploid amount of DNA, (2) that a certain correlation exists between DNA content and nuclear size, (3) that alpha-amino acid content is only one third of the DNA content, as estimated from ninhydrin-Schiff preparations and (4) that no polyploidy can be observed in pleurodeles liver nuclei.

Present findings demonstrate that some specific differences can be established with quantitative cytochemical methods.

THE ORIGIN OF THE CHARACTERISTIC FATTY ACID COMPOSITION OF WATER ORGANISMS

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While in land animals the major constituents of the fatty acid composition are restricted to the C 16, C 18 series, the fishes contain great amounts of fatty acids also with 20, 22 carbonic atoms. Searching for the origin of this characteristically complicated fatty acid composition, we analysed the fatty acids of the various members of the food chain algae-planktonic crustaceans-fishes. Analysis was carried out with quantitative paperchromatography combined with previous fractionation according to Twitchell and with hydrogenation. By means of this technique nor or hardly any fatty acids longer than C 18, were detected in algae but high iodine values indicated, that the C 16, C 18 series are dominated by polyunsaturated acids. Among the planktonic crustaceans the fat of the Cladocerans proved to be essentially similar to that of the algae, on the other hand, the Copepods contained always significant amount of C 20, C 22 acids. This amount changed seasonally; it was higher in summer than in winter, the process possibly ensuring the appropriate state of the extracellularly stored lipids. The Copepods growing in aquarium on algae contained also great amounts of C 20, C 22 acids in contrast to the fact that algae, originating from pure cultures showed no C 20, C 22 acids. Presumably in Copepods an intensive chain elongation takes place. Experiments show that the fat in fishes is deeply influenced by the food. We assume that the differences between the fatty acid composition of marine resp. fresh water fishes described more than 25 years ago could be explained by the different distribution of Cladocerans and Copepods in these waters and by the effect of the temperature on the Copepode fat.

INVESTIGATIONS CONCERNING DRY MATTER AND ELECTROLYTES IN SMOOTH AND STRIATED MUSCLES

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The amount of dry matter (exclusive of water and fat), potassium, sodium and chlorine has been determined in the following muscles of dogs: the smooth muscles of the mucosa-free bladder and intestines, and the striated muscles of the abdomen and thigh. These determinations

made possible to express the concentration of potassium and sodium with reference to lipid-free dry matter: besides, the intracellular K and Na-concentrations have also been ascertained with the aid of Cl-space calculations.

Present investigations have confirmed earlier findings regarding the intracellular potassium contents of striated and non-striated muscles.

Desalination by means of peritoneal administration of isoosmotic glucose solution causes the normal difference between the drymatter contents of the two kind of muscles to disappear: the amount of dry matter increases in the smooth muscles, and diminishes in the striated ones. Meanwhile, the amount of extracellular water decreases and that of intracellular water increases in both kinds of muscles. Changes in the intracellular cations are likewise discussed. A theory regarding the intracellular factors responsible for the observed differences between smooth and striated muscles is advanced.

NOTES ON THE PHYLOGENY OF THE CARDIAC CONDUCTION SYSTEM IN VERTEBRATES

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It was demonstrated by the present author in the earlier histological and histochemical investigations that the heart of lower vertebrates did not contain a separate system for the initiation and conduction of impulses. The muscle fibres, morphologically uniform, have presumably a double function in the heart of these animals: they perform physical work and ensure, at the same time, the initiation and conduction of impulses. The heart of the lower vertebrates is in this respect similar to that in higher orders.

The present experiments were designed to demonstrate this similarity from various angles. With a view to exploring their ultrastructure, the fibres in question were studied under the electron microscope. As in the case of the higher orders, only the presence of membrane Z was evident in the myocardial fibres of the adult vertebrates of the lower orders. The absence of membrane M and the presence of membrane Z show the similarity in the fine structure of the fibres.

With the use of heart extracts it was demonstrated that the heart of the adult individuals of the lower vertebrates is less differentiated. TÖRŐ *et al.* prepared an extract from the heart of higher vertebrate embryos which promoted the work of hypodynamic hearts. The active principle of the extract was termed corhormone, it is bound to the embryonic fibres and occurs in adults in the conduction fibres only.

For the purpose of the present investigations, extract was prepared with TÖRŐ's method also from the heart of adult crested newts. The effect of the extract was then tested on cultures of pulsating chicken heart as also on hypodynamic frog hearts. It proved to be the same as the effect produced by corhormone: it increased the rate of pulsation in the cultures and improved the work of the hypodynamic heart. It seems thus justified to assume that — in this respect at least — there is a close similarity between the less differentiated heart of the adult individuals of the lower and the embryonic heart of higher vertebrates.

DEVELOPMENTAL HISTOCHEMISTRY OF THE ARCHICEREBELLAR CORTEX

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In spite of the morphological uniformity of the cerebellar cortex, the histochemical pattern of the archicerebellum (nodulus, flocculi, lower uvula) characteristically differs from that of paleo- and neocortical areas; a fact which has been apparently overlooked by earlier investigators. Praesynaptic terminals of mossy fibres ("glomeruli cerebellares") exhibit a strong specific acetylcholinesterase activity in the archicerebellum, as contrasted with the

much weaker activity of phylogenetically younger lobes. (In the distribution of succinodehydrogenase and aspecific esterase, located also in the mossy ending, no such differences can be found.) Histochemical investigations performed on cerebella of embryos, new-born and young rats revealed that no cholinesterase activity was present in the cerebellar cortex till the 4th postnatal day. As early as on the 5th day, perikarya and dendrites of archicerebellar Purkinje cells exhibit a slight acetylcholinesterase activity culminating in a strong "staining" on the 8—12th days. From this time, enzymic activity of Purkinje cells gradually decreases and completely disappears on the 21st postnatal day. Cholinesterase-positive mossy fibres invade the archicerebellum on the 7th postnatal day. At first their helicoidal endings in the granular layer are located just below the row of Purkinje cells. Later, probably under the influence of granule cell bodies descending from the embryonal granule layer, these helicoidal structures become more compact, develop well-defined glomeruli with a strong acetylcholinesterase activity. With the standard histochemical technique employed (acetylthiocholine method after brief formalin fixation) mossy fibres and Purkinje cells of paleo- and neocerebellum do not show enzymic activity during development. It is concluded that the strong acetylcholinesterase activity of archicerebellar cortex may be due to its intimate connections with the vestibular nuclei.

NEUROHISTOLOGICAL INVESTIGATION OF THE FROG BRAIN

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The experiments were undertaken to obtain new data concerning the nervous system. The position of and the interrelations between the cerebral paths and nuclei were examined by means of traditional and partly with the aid of up-to-date and more exact methods of histology and nerve impregnation. Frogs of the species *Rana esculenta* were used. Serial impregnated sections showed the mesencephalon to be the most developed part of the frog brain, while it is the cerebral cortex and the thalamus which develop in the higher orders to primary centres. The fifteen cell layers of the optic lobe in the frog brain are, essentially, the highest nervous centre. However, the cellular pattern of the pallium shows a tendency of the cells towards forming a nucleus, a phylogenetically noteworthy phenomenon. The white matter is, at the same time, still outside, a fact which prevents a further differentiation of the surface of the grey matter.

The results of myelin staining tests, together with BAKER's phospholipid technique, justify the conclusion that the end of the dendrites and neurits lose their myelin sheath (optic lobe, cerebellum). The paths of the frog brain are more complex and have more connections than what has been described in literature. Neither the path between the rhinal region and the infundibulum nor that connecting the hypothalamus and the optic lobe have yet been described. Another unreported multiple connection of the tectum opticum is that with the cerebellum and with the medulla oblongata.

The ependyma is generally regarded as the sole supporting tissue of the frog brain. It lines the inner surface of the ventricles, as has been proved by several methods. Yet, experiments in which the silver-impregnation technique of BIELSCHOWSKY—ÁBRAHÁM was employed yielded results which seemed to be in contradiction to existing notions: the sagittal sections revealed the presence of ependyma cells below and before the lateral ventricle which, after detaching themselves from the ventricular wall, had migrated to the subpallium. The course of the migration seemed to have been cranial, ventro-lateral. The (originally single) process had divided into several branches which pointed in the direction of the migration (positive neurobiotaxis). The appearance of these emigrant glia cells is a phylogenetically noteworthy phenomenon.

INVESTIGATION OF THE FUNCTION OF HETEROTOPIC SPINAL CORD SEGMENTS IN THE CHICK

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On the third day of incubation the brachial spinal cord segments of chicken embryos were replaced by thoracic or lumbo-sacral segments taken from other embryos of the same age. In a third group, for control, the brachial segments were likewise exchanged for brachial segments of other donors. The trophic state of the musculature as well as motility and innervation pattern of the wings were studied after hatching.

The wings in the control group yielded normal function which indicates the capacity of the homoplastic brachial cord grafts to control normal wing movements. When brachial segments were replaced by thoracic ones, although normal nerves are developed in the periphery, the wings lost all motility and their musculature atrophized. The wings innervated by heterotopic lumbo-sacral segments showed synchronous movement in the shoulder joint with the legs on the same side. Peripheral arborizations of nerves of wing character and normal endplates and muscles were found.

The results show that only spinal cord segments from limb level are capable of controlling limb movements. As revealed by the movements of the wings the limb segments can select from the CNS impulses "addressed" to the limb for the innervation of which they are originally determined.

THE GROWTH OF SOME QUANTITATIVE CHARACTERISTICS IN PHEASANT, GUINEA FOWL AND DOMESTIC FOWL AT THE EMBRYONIC AGE

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The growth of the quantitative characteristics and of the kinetics of the increase were described by using the exponential and parabolic (allometrical) principle and equations. According to the results of comparative research work, the increase of some important quantitative characteristics of the embryo (net weight, dry weight, organic material, total ash, total calcium and total phosphorus), characterized by an exponential equation, is divided into phases according to the changes of velocity. In connection with the investigations the importance of the knowledge of the phases and transitions between the phases for the practical work of the incubation is stressed. There is a difference in the time-period of phases and in the growth velocity between pheasant, guinea fowl and domestic fowl but the number of the transitions between the phases is the same in all three cases, during the period from the 5th day of the incubation till the day of the hatching. As for the domestic fowl, the comparison of the embryonic growth of the races with extremely small or big body and their hybrid combinations was chiefly accentuated. It was possible to establish that, in the cases of explicit differences in the body mass, the phase changes of the allometrical relations, — corresponding to the findings in postembryonic heterauxesis for some mammalia (FÁBIÁN) — here are in no immediate contact with the age of the embryo either. The transition from an earlier phase to a later can be followed when the embryo reaches a definite weight. Finally, results obtained in researches related to the effect of the different incubation temperatures on growth and development of the domestic fowl embryo are emphasized.

EARLY STAGES OF PHAGOCYTOSIS IN THE ENDOTHELIAL AND KUPFFER CELLS OF THE RAT LIVER. AN ELECTRON MICROSCOPIC STUDY

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Phagocytosis of India ink particles was studied in the rat liver in intervals of 2 to 10 min. after intravenous administration of diluted India ink. In the 2 min. material, the particles were found partly free in the lumen of the sinusoid, partly absorbed on the surfaces of endothelial and Kupffer cells ("surface attachment phase"). 5 min. after the administration of India ink, the particles were seen in the cytoplasm enclosed in small vacuoles and in peculiar anastomosing bodies. The width of the latter was found to be about 1500 Å; it consisted of an outer limiting membrane and of a moderately dense substance which, in many instances, showed a fine striation perpendicular to the long axis of the body. The presence of the bodies was found to be closely related to phagocytosis; many of them contained phagocyted India ink particles. Their origin can be explained by lamelliform infoldings of the cell membrane which is covered by a 700 Å thick layer of medium density. The authors consider this layer to be composed of protein or mucoprotein molecules, arranged perpendicularly to the cell surfaces. End groups of the molecules may be responsible for the surface attachment of particles to be phagocyted.

ELECTRON MICROSCOPIC OBSERVATIONS ON THE MORPHOGENESIS OF THE BRUSH BORDER

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The brush border can be regarded as a special cell organelle which plays an important role in the function of certain resorptive and receptor cells (*e. g.* kidney epithelium, photoreceptor cells of invertebrates). The observations were made partly on regenerating eyes of planarians, partly on kidneys of rat embryos. The site of the brush border is indicated by the appearance of small (about 650 Å) vesicles in the peripheral cytoplasm. The vesicles are arranged later in rows perpendicular to the cell membrane. The fusion of these vesicles gives rise to clefts which, touching each other in lateral direction, surround cylindriform cytoplasmic areas, the microvilli. The clefts open on the cell surface so making contact with the extracellular space. The microvilli are therefore not evaginations of the cell surface but, on the contrary, formed in the peripheral cytoplasm by the fusion of vesicles, resp. clefts. The origin of the vesicles is not yet clear; they may be regarded as pinocytotic vesicles as well as special products of the cytoplasm. Analogies (formation of the retinal photoreceptors in vertebrates, blood platelets, nuclear membrane, etc.) indicate that fusion of vesicles is a substantial morphogenetic process of the cell in forming clefts and double membranes.

GRANULE FORMATION AND SUBMICROSCOPIC PLASMASTRUCTURE

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Several authors regard the neutral red formations as inclusions, granules or vacuoles and ascribe to them an enzymatic activity, a role in aster formation or in ciliary morphogenesis. These structures are even supposed to represent the "cleavage substance". In the present study

soil ciliates *(Colpoda fastigata* and *Platyophrya lata)* were vitally stained with neutral red and examined under the light and electron microscope.

Parallel with the decrease of protoplasmic movement during encystation a gradual desorption of stain from the binding substances takes place, probably from the polypeptides. Electronmicrographs show the formation of submicroscopic granules as a result of decreasing dispersity of the stain. The granules subsequently aggregate to form structures attaining the dimensions of mitochondria. The site of this process is rarely the subpellicular cytoplasm but most frequently the perinuclear cytoplasm where the granules form dense bodies. A different nature is exhibited by those staining granules which have a size of 0.8 to 1.3 μ and a predominantly meridional orientation. They are suggestive of being involved in ciliary morphogenesis. Cilia do not disappear, however, during encystment as shown by the uninterrupted ability of encysted animals to be induced to rotate, *i. e.* to use their cilia within the cyst membrane.

Electron micrographs show the loss of individuality of the submicroscopic particles during aggregation. No intensive participation of microsomes may be assumed, as the high degree of granule formation often observed would produce a total exhaustion of cytoplasmic RNA.

Two steps may be distinguished in the formation of granules: (1) a biophysical stage, depending on active metabolic processes. Oxidation decreases (some mitochondria show desorganization) which produces a change in the functional state of polypeptides binding the stain, so that desorption of the stain ensues. (2) A physical stage expressed in looser and later stronger interactions, formation of bonds between individual stain particles. Strongly aggregated granules, stain deposits are thus formed which could not be disintegrated even by ultrasonic treatment of various energy and frequency.

No membranes — characteristic of some inclusions — could be seen on ultrathin sections of granules. In fact the granules are products and indices of changes in cytoplasmic structure and metabolism. Their study may promote better understanding of protoplasmic changes.

COMPARATIVE SUBMICROSCOPIC STUDIES ON PARATHYROID SECRETION IN MAMMALS AND AMPHIBIA

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The ultrastructure of parathyroids from *Rana esculenta* and white rat was studied. Besides normal glands hyperfunctioning and hypofunctioning organs were also investigated. Shifts in gland function were induced by experimental hypo- and hypercalcaemia. Marked ultrastructural differences were found in the secretion cells of the two species. Changes in the intensity of the function of rat parathyroids are reflected in changes of cell types, further in nuclear and cytoplasmic differences. No changes of cell types could be observed in frogs. Authors assume that the leading part in secretion is played by the ergastoplasm in the case of rat, whereas in frog parathyroids with less developed ergastoplasm this function is performed mainly by secretion granules and the Gogli-mitochondrial complex.

ELECTRON MICROSCOPIC OBSERVATIONS ON THE HARDERIAN GLAND OF THE RAT

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In the cytoplasm of the Harderian gland of infantile and adult rats four types of cells may be distinguished, which represent well-defined stages of the development and functional activity of the gland. The first two cell types (I and II) are mainly observed in the glands of infantile animals, their cytoplasm is poorly differentiated, loose, and contains only a small number of vesicles. In the types III and IV the number of the vesicles increases continuously, and the cytoplasm is very dense.

We have also examined the genesis of the vesicles (secrete-granules) occurring in the cytoplasm. According to our observations the unsaturated lipids of the vesicular membranes

arise from the well-developed cytoplasmic Golgi apparatus, which is the most pronounced in the cell type IV. The intravesicular saturated lipids, which are not regularly preserved in the electron microscopic sections, result from dehydrogenation of the unsaturated lipids of the vesicular membranes.

ELECTRON MICROSCOPIC INVESTIGATIONS OF THE STRIATED MUSCLE DURING THE EXTRACTION OF PROTEINS

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Many workers believe that actin is the fibrillar protein which runs through the whole sarcomere, and to which at the A-band the myosin filaments join. Our investigations of the muscle proteins indicated, that from the striated muscle after the extraction of actin an equal quantity of another protein can be extracted. This finding raises the question: where are the muscle proteins localized in the myofibrillar structure? To approach this problem during the extraction of different proteins the electron microscopic structure of myofibrils was investigated.

In the experiments m. psoas of rabbit was used. The muscle was treated in two ways: after decapitation of the animal (a) the muscle was chilled to 0 centigrade as soon as possible, (b) the muscle was allowed to go in rigor at room temperature. In both cases, thin bands of muscle were taken out. The muscles proteins were extracted according to our biochemical experiences. The samples were embedded and examined under the electron microscope in the usual way.

After the extraction of myosin with Hasselbach—Schneider solution the protofibrillar structure of myofibrils remained, but the electron-dense material of the A-band disappeared. After the removal of actin with Weber—Edsall solution for 24 hours, the protofibrillar structure was still preserved. The protofibrillar structure was destroyed only after an extraction with 5 m urea or glycine solution at pH 9—11. The muscle in rigor behaves differently. After extraction of proteins with Hasselbach—Schneider solution the difference of electron density between the A and I segments becomes more significant. This structure does not change after treatment of the muscle with Weber—Edsall solution. The effect of urea is the same as with relaxed muscle.

The protofibrillar structure of myofibrils is accordingly given by a protein extractable with an alcalic urea or glycine solution. To this protein are attached the actin and myosin in the A band. These two proteins are not connected in the resting muscle, but in muscles in rigor they combine to actomyosin which is very resistant to the extracting procedures.

ELECTRON MICROSCOPIC INVESTIGATIONS OF THE INNERVATION OF LEG MUSCLES IN INSECTS

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Innervation of the femoral muscle of the metathoracic leg of *Dytiscus marginalis*, *Hydrous piceus*, *Oryctes nasicornis*, *Apis mellifica* was studied with the electron microscope. In the last three species the innervation is of the end-plate type; two different axons ensheathed by an extensive folding of the lemmoblast can be observed, containing synaptic vesicles or osmiophilic granula respectively. This phenomenon is briefly discussed with respect to polyneural innervation. Synaptic contact is established between the terminal part of the axon running longitudinally along the muscle fibre and pillar-like protrusions of the postsynaptic end-plate pillock, arising from the sarcomeres and alternately reaching the naked axon — *i. e.* small fields not covered by the lemmoblastic sheath — from both sides. Thus the synaptic articulation surface is divided into small patches of true attachment separated from each other by regions covered by the lemmoblastic sheath. The postsynaptic plasma of the muscle fibres is rich in endoplasmic reticulum and vesicles of different size.

In contrast to the former no end-plates are found in *D. marginalis*. The preterminal part of the — generally single — motor axon runs parallel with the axis of the muscle fibre and gives off small transversal terminal branches which run regularly in the middle of almost each sarcomere firmly attached to the inner lamina (muscle plasma membrane) of the sarcolemm and simply covered from the outside by a thin sheath of lemmoblast. Only a single type of synaptic vesicles of the usual 400 Å diameter could be found in the terminal fibres, the postsynaptic plasma having the same dense "rete synapticum" as in the end-plate type. The difference in innervation found between species belonging to the same order *(D. marginalis* and *e. g. O. nasicornis)* is discussed from the functional point of view.

ULTRASTRUCTURE OF THE VARIOUS FIBRES OF THE MYOCARDIUM

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The cardiac fibres of white rats have been electron microscopically and optically examined. In the ventricles only one type of muscle fibres can be found, whereas in the wall of the atria there are various types of fibres. They may be classified in three groups: (1) Common atrial muscle fibres occurring in the greatest number. No considerable difference exists between these fibres and those of the ventricles except for the atrial fibres possessing a somewhat smaller diameter and containing somewhat fewer myofibrillae. (2) The "light muscle fibres" named so by Bompiani, Rouiller and Hatt as the electron density of these fibres is low. They are poor in myofibrillae but richer in cytoplasm. Consequently they bear resemblance to the structure of the fibres of the special conduction system. These "light fibres", however, are not found everywhere in the atria. They are most numerous in the musculi pectinati of the auricular wall, in the orifice of the great vessels and scattered in the subepicardial layer. These fibres do not connect the sino-atrial node with the atrio-ventricular one. Consequently it is unlikely that they have any special role in the conduction system. The fibres of the atrio-ventricular node are transformed from the common atrial fibres. (3) The Purkinje-type fibres are found in the vicinity of the sinoatrial node, in the connective tissue of the atrio-ventricular ring. The ultrastructure of these fibres is identical with that of the ventricular Purkinje-type described in one of our earlier papers concerning the conducting system. Nevertheless more mitochondria are found in the atrial Purkinje-type fibres. The classification of the different types of the atrial fibres is not always feasible as there are also transitory types. *E. g.* it occurred that one segment of the muscle fibres in the connective tissue was of common type while the other one was Purkinje-type. The morphology of the atrial fibres may be influenced by the intensivity of their contraction.

ELECTRON MICROSCOPIC OBSERVATIONS ON NEUROSECRETORY CELLS OF THE EARTH WORM, LUMBRICUS TERRESTRIS

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The storing neurosecretory cells of the cerebral ganglion contain a large number of elementary granules with an average diameter of 280 mμ. In these cells only a few ergastoplasmic cysternae are found and the Golgi substance shows no sign of secretory activity. In the "empty" neurosecretory cells, ergastoplasmic elements and small vesicles dominate. The Golgi substance of these cells occupies a greater area and contains in its cysternae and vesicles a homogeneous dense substance, very similar to the neurosecretory material. This intimate relationship between Golgi substance and secretory material suggests that the Golgi substance plays an important role in the secretory process. Bodies greater than mitochondria, with a dense granular or homogeneous substance were observed in both neurosecretory and glia cells.

Transitory forms indicate that these bodies can be derived from mitochondria; their lysosomic character cannot be excluded. Dilatations of the intercellular space, intercellularly located neurosecretory granules, dense fusiform granules under the basement membrane of capillaries indicate a possible route of emptying of the neurosecretory material.

PARTHENOCARPY AND APOMIXIS IN THE RIBES GENUS INDUCED BY GIBBERELLIC ACID

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In the *Ribes* species, particularly in the cultivated black currant *(Ribes nigrum* L.) varieties disturbances of fertilization and consequently early fruit drop is a widely occurring phenomenon. Although the role of auxins present in the fruit and regulating fruit drop was demonstrated in exact experiments, the fruit drop of black currant varieties could not be inhibited by spraying with auxins. Since gibberellic acid was shown to be effective in inducing parthenocarpy in a number of fruit trees experiments were set up to increase the fruit set of *Ribes* species by the application of this agent.

The castrated and isolated flowers of red, white and black currant varieties and those of gooseberries were sprayed 5 days after the removal of anthers with 100 p. p. m. indoleacetic acid, 100 p. p. m. gibberellic acid and with a mixture of these two substances. A similar treatment was given to *Ribes gordonianum* Lem. and *Ribes culwerwelli* Macfarl., entirely sterile but heavily blooming interspecific hybrids. The experiments were evaluated at fruit ripening So far as the induction of parthenocarpy is concerned gibberellic acid proved effective with all black currant varieties, whereas of the red and white currant varieties included in the experiments only the White Versailles variety gave positive results. The combined treatments (gibberellic acid + indoleacetic acid) apparently surpassed the effect of gibberellic acid applied alone but the differences were non-significant. However, the combined application of gibberellic- and indoleacetic acids resulted in a marked synergetic stimulation of parthenocarpic fruit setting in the Grüne Riesenbeere gooseberry variety. The sterile hybrids responded very sensitively to spraying with gibberellic acid: 60 to 100 per cent parthenocarpic fruit set was obtained.

In three black currant varieties the combined treatment of castrated and isolated flowers resulted in the formation of parthenocarpic fruits and also in the induction of apomixis, a phenomenon not known so far in the *Ribes* genus. The results show that the gibberellin-type substances play an important role in the inhibition of fruit drop of black currant varieties. It is also remarkable that the inherited sterility of entirely sterile interspecific hybrids could temporarily be released by treatment with gibberellic acid.

THE ROLE OF NUCLEIC ACID FROM LYSOGENIC BACTERIA IN THE GENETIC TRANSFER OF IMMUNITY TO THE SENSITIVE CELLS

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It was previously reported (Biochim. Biophys. Acta 47/1961. 215—217) that NA prepared from *Rhizobium meliloti* 41 which is lysogenic for the temperate phage 16—3, increases the number of survivor cells from the same but sensitive strain. The tester phage for immunity was the clear plaque mutant 16—3 vl *l* of the original temperate phage 16—3. In an effort to elucidate this phenomenon the most probable interpretation was, that the effect of NA on sensitive cells was a genetical transformation, and the transferred character was the immunity of the lysogenic bacteria, which is conferred by the prophage. Our recent experiments demonstrated that the effect of transforming NA was inhibited by desoxyribonuclease treatment. This indicated that the DNA was effective in the NA preparations. The transferring DNA did not influence the adsorption of the phages 16—3 vl *l*. In our experimental conditions the rate constant for the adsorption of the phage 16—3 vl *l* remained unchanged to the treated cells. The

DNA incorporation was traced by labeling with P^{32}. The effect of concentration of transforming DNA and the multiplicity of infecting tester phage on the number of survivors was also investigated. Increasing the concentration of transforming DNA, the number of survivors increased up to an optimum. Above that concentration, the survival of bacteria decreased. From the transformation experiments it is known that the addition of an inert DNA decreases the effectiveness of the transforming one. Plotting the number of survivors against the DNA concentration it was found that only a fraction of the transforming DNA used was active in the transfer of immunity, while the other proved to be inert. Increasing the multiplicity of infecting phage at optimal DNA concentration the number of survivors decreased. The most effective value of multiplicity was found about ten. A similar relation was already reported for lysogenic cells. These experiments support our earlier assumption that the DNA prepared from the lysogenic complex transfers the immunity via genetic transformation into sensitive cells.

BACTERIOCINOGENIC STRAINS OF PSEUDOMONAS TABACI

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In 1961 we undertook the screening of a great number of isolates of *Pseudomonas tabaci* with the aim of obtaining lysogenic strains. By the means of spot test they were tested against each other in all possible pairs. However, it turned out that several isolates were bacteriocinogenic. While the tests were extended on other strains kindly provided by Dr. Z. Klement (Budapest), Y. Hamon (Institute Pasteur, Paris) informed us, that quite recently he also observed bacteriocinogeny in two other phytopathogenic *Pseudomonas* species, *i. e. P. aptata* and *P. lachrymans*. Several bacteriocinogenic and indicator strains of *P. pyocyanea* and a strain of *P. fluorescens*, obtained by the courtesy of Mr. Hamon were also included in our further experiments. Screenings were performed with the spot test, and with the double-layer technique of Gratia and Frédéricq. Out of thirty strains of *P. tabaci* tested, four produced bacteriocin, and three strains (two *P. tabaci* and one *P. angulata)* proved to be very sensitive indicators. The antibiotic principle was temperature labile, not dialyzable through cellophane membrane and absorbable to G4 glass-filter. It was not transmissible, not transferable by subculturing and did not multiplicate in the sensitive strains. We tried to concentrate the bacteriocin by the usual chloroform treatment as well as to induce by UV-rays but without success. The obtention of streptomycin-resistance by mutation did not impair the bacteriocinogeny or sensitivity in the respective strains. Treatments with acridine orange were effective and some of the colonies lost their bacteriocin productive activity. The bacteriocin produced by the *P. tabaci* strains were also effective against several strains of *P. pyocyanea* and *P. fluorescens*. As the range of action of the bacteriocin produced by *P. tabaci* seems to be different from that of pyocin and fluocin, it is tempting to imagine that it can be distinguished as "tabacin" from the other types of pseudomonadicins already described.

THE MORPHOGENETIC EFFECT OF AN ALBINO FACTOR IN MAIZE

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In previous experiments it was established that the ratio of coleoptile and mesocotyl length (K/M ratio) of four days old maize seedlings shows a discontinuous variation. The normal green seedlings of the homozygous dominant category and of the heterozygotes indicate a phenotypically lower variability than the individuals of the recessive homozygous category (*i. e.* the albino mutants). Different external factors (light, heat, 10^{-3} M 2,4-D, TIBA) bring about a K/M value higher than 1 characteristic of the phenotype of the albino mutants also in normal seedlings. As effect of heat-treatment partial phenocopy can be observed. The applied treatments did not cause allelic changes in the K/M values of albino mutants. The connection of genotypical and phenotypical variability was studied. The degree of mesocotyl

growth as compared to coleoptile growth (*i.e.* the K/M ratio) depends also on the total length of the shoot, and portrays the state of ontogeny more exactly than age expressed by time (in hours, or days). The genotype of the embryo of normal green plants determines a broad range of possibilities in degree of mesocotyl growth as related to coleoptile (as well as in values of K/M). It depends on the environmental and internal factors which of the values out of the K/M possibilities determined by the reaction norm of normal genotype will be realized phenotypically. (IAA, NAA, PCMB do not alter the K/M ratio of normal seedlings, whereas it changes allelically if the seedlings are treated with light, heat, 2,4-D, and TIBA.) The possibilities of phenotypical realization in mutants are restricted by the gene of albinism, therefore only K/M values higher than 1 can develop under the conditions investigated. Thus it is evident that a considerably broader range of possibilities is determined by the genotype of normal green seedlings than by the genotype of homozygous recessive albino mutants.

A CYTOLOGICAL STUDY OF THE FIRST AND SECOND GENERATION PROGENY FROM SESQUIDIPLOID HYBRIDS OF LYCOPERSICON PIMPINELLIFOLIUM AND L. PERUVIANUM

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Sesquidiploid hybrid plants were obtained by the pollination of tetraploid *Lycopersicon pimpinellifolium* with diploid *L. peruvianum*. The vegetatively propagated hybrids were transplanted to the field where the natural fruit set was poor, and the mean number of seeds per fruit was only one. The wide range of chromosome numbers in the first generation progeny was indeed surprising; plants with complements from 26 to 34 were observed, the majority of these plants having $2n = 32$. The number of the extra chromosomes decreased in the second generation progeny derived from uncontrolled pollination in field conditions, and the chromosome number ranged from 24 to 32 with the mode at twenty eight; however, one plant had the number thirty eight, and another one forty. The average vigour of plants with many extra chromosomes was hardly impaired. The plants exhibited a very striking variation in the morphological appearance with a wide range of association of characters of the two parental species. However, no correlation could be detected between the external morphology of the individual plants and the number of chromosomes. The majority of the chromosomes were paired and trivalents occurred very frequently. Many cytological abnormalities were observed; laggards, delayed separation of bivalents, precocious division of univalents, bridges, elimination of chromosomes. There was a great variation in regard to the distribution at anaphase I according to the chance position on the unoriented univalents and random assortment of the extra chromosomes of the trivalents. All these irregularities lead to unbalanced chromosome numbers in many gametes, although the presence of high numbers of extra chromosomes did not impair very seriously their function. The unexpected composition of the two generation progenies of the sesquidiploid *L. pimpinellifolium* $\times$ *L. peruvianum* provides a further evidence to the observations of Soost, and Rick and Notani, respectively, that the tolerance of extra chromosomes is greater in the primitive or wild genotype than in the highly selected cultivars of *L. esculentum*.

Abstracts of papers read by title only

HISTOCHEMICAL CHANGES DEVELOPING IN NORMAL RATS TREATED WITH SERUM OF HEPATECTOMIZED RATS

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Earlier studies revealed characteristic histochemical changes in the remaining part of liver in partially hepatectomized rats. The changes include a marked drop in the activity of succinic dehydrogenase and cytochrome oxydase and a temporary, but considerable increase in the activity of alkaline phosphatase and adenosine triphosphatase. The serum of hepatectomized animals (HAS) is known to contain a factor eliciting regenerative phenomena in liver when injected into normal animals. In order to obtain further data concerning tissue restoration some histochemical properties were studied in the liver of normal animals treated with intraperitoneally administered HAS. Young male albino rats obtained intraperitoneal injections of HAS (2 ml.) every 3 days. Appropriate controls were included in the experiments. Groups of animals were killed 1, 6, 9, 30, 60, 90 days and 7 months after the beginning of the experiment. HAS-administration produces enzymhistochemical changes in normal animals under acute circumstances similar to that in regeneration. The activity of succinic dehydrogenase and cytochrome oxydase significantly diminishes and that of adenosine triphosphatase strongly increases also in this case. The reduced activity of oxydative enzyms is a temporary phenomenon and on the 9th day the activity rises again. Adenosine triphosphatase activity, however, remained at a higher level during the full observation period. Differences were noted moreover in the RNA and DNA content of liver cells as shown by histochemical methods. In early stages an increased pyroninophilia of enlarged nucleoli is most characteristic besides a stronger cytoplasmic staining. The first change referred to disappears but the second one remains in liver cells of animals subjected to chronic treatment. DNA content of nuclei (as ascertained by the Feulgen reaction) changes only in the chronic period. Hyperchromatic nuclei, frequently much larger than normal ones appear in increasing number after the first month. These changes point to increased ploidy. Histochemical findings show, accordingly, marked changes in liver tissue metabolism of normal animals under the effect of HAS, a detailed study of which may contribute valuable data to the understanding of the mechanism of regeneration.

CYTOLOGICAL STUDIES ON THE CENTRAL NERVOUS SYSTEM OF FRESH WATER MUSSELS WITH SPECIAL REGARD TO NEUROSECRETION

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The present studies were performed on the cerebral, pedal and visceral ganglia of *Anodonta cygnea*. The material was fixed in Bouin, embedded in paraffin and stained with paraldehyde-fuchsin of Gabe. The presence of neurosecretion was noted in all ganglia. Cells containing secretion may be divided in three groups. The most frequent *A* cells are egg-shaped or pyriform, of medium size and have nuclei rich in chromatin. Their short and thin axons are lost in the cortical substance. *A* cells are filled with dense colloid-like substance for the most of the year. The mainly unipolar *B* cells are the largest, and have vesicular nuclei. These infrequent cells are found in the central zone of the cortical substance in all ganglia. Their thick neurits cross the cellular cortical zone and are lost in the neuropil. The cytoplasms of the *B* cells reveal a great variation in respect to their secrete content. Author regards the cells containing different amounts of secrete to correspond to different stages of the secretion cycle. Cells containing little Gomori-positive material at the level of the Golgi zone represent the initial stage of the

process, whereas cells with more secrete are in more advanced stages. Cells full of Gomori positive material are in the storing stage. The small *C* cells with small cytoplasm and dark nuclei are numerous at the border of cortical and medullary substance. From morphological point of view they belong to glial cells. These cells also contain Gomori-positive substance but do not reveal changes which could be attributed to a neurosecretion cycle.

THE PHYLOGENY OF MOSSES IN A NEW LIGHT

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In connection with studying the newest literature, the works of Savicz-Ljubitzkaja, Steere, Naumova, Mägdefrau and Neuburg, the authors formed their own opinion on the taxonomy and phylogeny of mosses.

The plants called Bryophyta differ from each other in such a high degree that by comprising them in one family and in merely three classes the present demands are not satisfied. Hepaticae and Musci include equally several independent succession lines. Within Hepaticae the relatives of *Riccia*, *Anthoceros*, *Marchantia*, *Frullania*, among Musci those of *Sphagnum*, *Andraeae*, *Splachnum*, *Buxbaumia*, *Schistostega*, *Polytrichum* will presumably reach the rank of an independent class as it already happened with Anthrocerotales. According to the authors *Sphagnum*, *Andraeae* and the other Musci are farther from each other than Monocotyledones from Dicotyledones.

Cytological investigations elucidated the relationship of mosses from a new aspect. The sporogonium of Hepaticae (except of the *Anthoceros* species containing 5 chromosomes) shows a low morphological variability and in most Hepaticae the number of chromosomes is n = 9 and only a few have 8 or 10, whereas the capsula of the Musci and their peristomiums are extremely various; the differences of their form are taxonomically important. The number of chromosomes fluctuates within wider limits (from 5 to 66) than in Phanerogamae.

The oldest exactly determined moss fossils came to light from the Perm and Carbon ages but they are by no means more primitive than the recent forms.

The theory that Bryophyta are nothing else than reduction-originated descendants of certain primordial Pteridophytae called Psilophyta, cannot be accepted by bryologists. Most species of Bryophyta are able to regenerate themselves to full individuals from a bit of their body, a property inherited from Thallophyta ancestors. If Bryophyta derived from primeval Psilophyta, they should have regained a lost property: a regenerative capacity of high degree, but this would be in contradiction to the rule of Dollo.

Naumova pointed out that already in layers of the Silur and Devon ages sporae may be found which are considered by her as of Bryophytae and partly as of primordial Pteridophytae, moreover, she detected in layers of the Precambrium sporae of a plant more developed than algae.

EFFECT OF THYMECTOMY ON PHOSPHORUS (P^{32}) METABOLISM IN RAT TESTIS

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As part of a comprehensive study on thymic-gonadal interactions the effect of thymectomy on phosphorus metabolism in testes of young (50 to 70 g), adult (140 to 150 g) and aged (300 g) white rats was examined. After intraperitoneal administration of inorganic labelled phosphorus the tissues were subjected to a modified Davidson procedure (as described by the authors in another communication). Thymectomy had the most marked consequences in adult animals. A strong increase in the specific activity of testis-DNA-P appeared as early as 12 hours after thymectomy and was especially explicit after 3, 7 and 14 days. Specific activity of the acid soluble fraction (containing the ATP) also increased. No changes were observed in the specific activity of RNS-P. No similar shifts could be found in young and old animals. The percentual distribution of the stages of spermiogenesis in the tubuli contorti did not reveal any changes thus pointing to a proportionate acceleration of all spermiogenetic phases under the effect of thymectomy.

INVESTIGATION OF AUXONHERBICIDES AND OTHER TYPES OF GROWTH-PROMOTING AGENTS IN CONNECTION WITH RESISTANCE AND GROWTH

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The intent of the present investigations was to answer two questions: (i) to what extent does the double effect of auxonherbicides — promotion of growth and toxicity — depend, besides concentration, on molecular configuration; (ii) how does a combination of different types of auxons influence growth-promotion?

Mass cultures of potato *(Solanum tuberosum)* tissue, grown with our own technique, were used. The auxons were divided into four groups: *auxins*, *phenoxy-acetic-acid regulators*, *gibberellins* and *kinetines*.

In contrast to other workers and to earlier observations of the present authors, higher concentrations of *β-indoleacetic acid* promoted growth in potatoe-tissue cultures also; combined with dichlorophenoxyacetic *acid* (2,4-D) it showed pronounced synergism (10^{-4}M × 10^{-4}M). Resistance to, and type and intensity of growth released by, *phenoxyacetic acid* varied with the seven members of this series. It appeared that substitution of Cl and CH_3, respectively, for the 4th and 5th carbon atom was more significant than the two-point attachment. *Gibberellic acid* (10^{-6}M—10^{-4}M) produced neither auxonic nor toxic effect; it antagonized the action of 2,4-D(10^{-5}M) and modified the type of growth as also the formation of pigments. *Kinetine*, administered alone, produced practically no effect, while its combination with the optimal concentration of 2,4-D resulted in intensified (additional) growth promotion. Kinetine does not increase toxicity. Our observations concerning a combination of *dicumarol* and 2,4-D were noteworthy: the latter arrested or markedly diminished the investigations, the effects of the different auxons are interdependent, and — apart from depending on molecular configuration and concentration — governed by their position in the regulatory system.

THE ROLE OF LEUCINE IN CAROTENOID AND CHLOROPHYLL SYNTHESIS

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The biosynthesis of carotenoids and that of phytol in the chlorophyll have been studied. These studies were prompted by earlier investigations concerning albino plants according to which the development of abnormal carotenoid is a decisive factor in the photodestruction of chlorophyll.

Recent reports affirm that the chlorophyll contents of barley seedlings can be increased by treating them with leucine, a phenomenon ascribed to higher rate of structural-protein synthesis. The experiments of Braithwaite and Goodwin with *Phyomyces blakesleanus* made it probable that leucine was involved in carotenoid synthesis. With the infiltration of leucine, uniformly labelled with ^{14}C, into the leaves of barley seedlings, further with the chromatographic separation of the pigments we tried to decide whether leucine was directly involved in the synthesis of leaf pigments.

The carotenoids in the leaves displayed marked activity whether the seedlings were kept in the light or in the dark. In darkness, the specific activity of the carotenoids reached — within 4 to 6 hours — a state of saturation and amounted to 170 per cent of cellular leucine activity. Exposure to light increased this figure to 270 per cent. Assuming 8 leucine molecules to be necessary for the synthesis of a carotenoid molecule, it would follow that about 20 to 30 per cent of the leaf carotenoids were built up from radioactive leucine. Leucine was incorporated into the chlorophyll molecules as well, though to a lesser extent. Uptake by the phytol of the chlorophyll increased with extreme rapidity in light. The inference seems therefore justified that the action of leucine by which it promotes the differentiation of chloroplast and inhibits photodestruction is based — beyond the promotion of protein synthesis — on the fact that it constitutes a direct precursor in the synthesis of isoprenoids in the plastids.

INFLAMMATION AND pH

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Inflammation is the consequence of a tissue-trauma. The pH of the inflamed tissue is acid. Acidosis provokes the migration of leukocytes from the higher to the lower pH. It is well known that acidosis induces sympathomimetic effects and increase of calcium-level. Histamine is an acid material and the chief activator of RES. (Perhaps the biological primum movens of the ACTH-mobilization.) It is an interesting question how can alkali decrease the inflamed reaction of the tissues. 72 hours after the intravenously administered Congo-red and subcutaneous histamine the skin becomes red on the place of the injection. (The capillary endothelium becomes RES by histamine.) On the place of antihistamine inj. (*e. g.* suprastin) a white area (inhibition of phagocyte-activity) is seen. The examined acid materials (nicotinic acid, merapid, salicylic acid) produced similar effects as the histamine and the alkali materials ($NaHCO_3$, suprastin, pipolphen) have inhibited the phagocytosis. There are, however, alkaline histamine-liberators (adrenalin, tubocurarin) too. In this case the alkali effect is only one factor the other factor being histamin mobilization. According to these examinations the pH of a material is only one factor to be examined together with the others. If an alkaline material decreases the local phenomenon of the inflammation, the defence against the infection diminishes too. The result of these investigations are important for infection therapy.

EFFECT OF HEPARIN AND ITS COMPONENTS ON MUSCULAR CONTRACTION

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The present studies were performed on isolated frog hearts on a Straub canule. Heparin depressed the heart function and had a diastolizing action, as also observed by earlier authors. The heparin binding protamine-sulphate quickly stops the heart between systole and diastole. Drugs having a direct effect on the sinus node (atropine, adrenaline) did not alter the effect of heparin or protamine-sulphate. Ten per cent calcium chloride restored the heparin depressed heart much faster than pure Ringer solution. Heart stopped in systole under calcium effect starts beating after addition of heparin. The experiments thus revealed an antagonistic action of heparin and calcium on frog heart. The effect of components of heparin was also tested. Glucosamine proved to be ineffective, whereas glucuronic acid had a heparin-like effect. Fresh solution of the lactone of glucuronic acid was also ineffective but became effective after 24 hours. A mixture of equal parts of the lactone of glucuronic acid and glucosamine had also a heparin-like effect. All these experiments show that the effect of glucuronic acid is enhanced by glucosamine. However, a role of the sulphate groups in the complete heparin molecule can not be ruled out, as systolic calcium contracture can be anulled only with complete heparin and not with glucuronic acid or with a glucosamine-glucuronic acid mixture. Authors suggest that heparin acts through a sol-gel mechanism.

LATE PLIOCENE PLANTS FROM THE COUNTY VAS (W. HUNGARY)

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Research work conducted in these last years succeeded in discovering in the area of the county Vas some sites of fossil plants which make it possible to gain an insight into ages hitherto unknown in Hungary as to their floristic aspect. The recently discovered fossil localities are: Sótony, Kemenesmihályfa, Olaszfa, Gersekarát and Sé. Fossil plants of the same age were found besides the county Vas also at Hidegség, county Sopron and near Aszód, county Pest. As to this time the following plant species were found: *Chara* sp., *Osmunda parschlugiana* (Ung.) Andreánszky, *Pteris* sp., *Salvinia natans* (L.) All., *Glyptostrobus europaeus* (Brngt.) Heer, *Ranunculus* sp., *Betula pendula* Roth, *Alnus incana* (L.) Mnch., *Myrica* spp., *Salix cinerea* L., *S. fragilis* L., *S. alba* L., *S. dasyclados* Wim., *S. viminalis* L., *S. elaeagnos* Scop., *S. repens* L., *S. repens* L. *ssp. rosmarinifolia* Celak., *S. retusa* K., *S. caprea* L. (?), *Iris pseudacorus* L., *Phragmites communis* Trin., *Typha latifolia* L., *T. angustifolia* L. The fossil bearing

layers are considered as belonging to the uppermost part of Late Pliocene. This age is supported besides a series of various stratigraphic reasons by the greater part of the complex of the plant remains between which the species of *Salix* predominate; as to frequency they approach their maximum during the Prepleistocene. The discovery of *Glyptostrobus europaeus*, *Osmunda parschlugiana* and *Pteris* sp. in recent time, is to a certain extent in contradiction with this statement time, these plants required a higher temperature. But if we consider the fact that *Glyptostrobus* in various localities of Central-Europe persists through the winter, it is imaginable that under a similar climate it may have occurred at relatively low temperatures indicated by the other fossils found together. At the end of Late Pliocene in the greater part of Hungary a cool and moist climate was dominant. The fossil remains imbedded of *Glyptostrobus*, *Osmunda* and *Pteris* indicate still strong connections with a warm-temperate Pliocene flora, while the fossil type considered as *Salix retusa* may announce in advance the approach of the glacial period. The cohabitation of types representing two different climates in a restricted area must have partly biological and ecological, partly geographical reasons. Our fossil plants determine consequently the final period of the Late Pliocene and thus they may be used as indicators in stratigraphy. From the point of view of botany we obtained informations which enable us to form an idea on the plant life of the epoch immediately preceding the glacial period, at least for the aquatic and riparian vegetation respectively.

HISTOCHEMICAL EXAMINATION OF EBERTH'S LINES IN MAMMALIAN HEART MUSCLE

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Electron microscopic studies of mammalian heart (van BREEMAN, SJÖSTRAND and ANDERSSON, MOORE and RUSKA) support the view that Eberth's lines are specialized junctions between cellular units of the myocardium. Based on these investigations the author examined the histochemical structure of the Eberth's lines. According to RAVIN and co-workers esterolytic activity of the myocardium as revealed by the naphthyl acetate and indoxyl acetate methods is localized in a diffuse or granular form, without any cytological localization. Author found in his experiments carried out by the Holt indoxyl acetate technique (modified according to SÁVAY and CSILLIK), that the Eberth's lines and borders of muscle cells exhibited an intensive reaction, thus producing a mosaic-like pattern with a diffuse background activity. The reaction was completely inhibited by a pre-incubation in 10^{-3} M eserine. Further experiments performed by means of the Crevier—Belanger thiolacetic acid method for cholinesterase revealed no reaction in the working muscle. According to GOLDSTEIN, Eberth's lines show a well-defined periodic acid-Schiff positivity. Attempts were therefore made to facilitate the penetration of the chromogenic substrate by means of an enzymatic depolymerization of mucopolysaccharides. Rats were killed by producing a diastolic block injecting intravenously 5 per cent potassium chloride solution and small pieces of the right ventricle were incubated at room temperature in a 10 per cent hyaluronidase solution ("Hyason", Organon) for 10 min. After this treatment frozen sections were cut without fixation and "stained" for cholinesterase by means of the Crevier—Belanger method. Five-minutes incubation resulted in the characteristic pattern of Eberth's lines. The enzymatic activity could be completely inhibited by pretreating the sections with 10^{-3} M eserine. Di-isopropylfluorophosphonate (5×10^{-6} M) had no effect. According to these investigations, Eberth's lines seem to contain a specific enzyme, the activity of which, however is masked in some way ("crypto-enzyme"). Cholinesterase present in the surface membranes connecting neighbouring cells might play a certain role in the transmission of impulses from cell to cell as in myoneural junction.

SEASONAL OBSERVATION OF THE EFFECT PRODUCED BY MELANOCYTE-STIMULATING HORMONE (MSH)

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It is known from comparative anatomy that, relatively, the intermediary lobe is largest in the pituitary of fish living under constant atmospheric pressure in the water. Intermedin has been used for 40 years by ophthalmologists in cases of the pigmentary degeneration of the

retina. Transplantation of the pituitary of the carp (*Cyprinus carpio* L.) was routinely performed in our hospital since 1959. Since 1961, not the hypophysis of the fish itself, but the hypophysis of other animals which had been treated with carp pituitary, is transplanted to patients suffering from retinal degeneration. It was found between 1959 and 1961 that results were more satisfactory in certain seasons of the year and less so in others. The necessity arose, therefore, to elaborate a method suited to ascertain the most favourable period for transplantations and which, moreover, would prove the correctness of the assumption that the transplantation of the pituitary gland of animals pretreated with fish hypophysis gave actually better results than a direct transplantation of the carp pituitary. It was first thought that the determination of gonadotropic hormone would solve the problem, but the considerable margin of error in Galli—Mainini reaction necessitated the search for another method. The simplest procedure seemed to be a systematic observation of the effect of intermedin. Observations conducted for a year, have yielded the following results:

The effect of MSH is most pronounced in May, June and July, *i. e.* during the period of spawning. By means of a method, known in fish biology, the effect of the MSH can be increased by 40 per cent during the period of spawning. Led by these considerations, the transplantation is now performed in the above hospital between May and July, and clinical results have fully justified this practice. As regards the above-described indirect transplantation, the number of cases is not large enough so far to justify definite conclusions.

EXPERIMENTAL STUDIES ON POLYMORPHISM IN ANKISTRODESMUS AND KIRCHNERIELLA

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Polymorphism, with special regard to morphogenetic factors, was studied in clone cultures and natural mass productions of the unicellular green algae *Ankistrodesmus* and *Kirchneriella*. Polymorphism occurred mainly as a "*Chlorella* cycle", but mutual imitation of characters was also seen. The *Chlorella* cycle manifests as production of round cells during ontogenesis. In *Ankistrodesmus* this phenomenon has already been described by Beijerinck at the end of the last century and was recently discussed by McMillan. Present author also found an infrequent replacement of normal division by divisions producing round autospores subsequently developing into typical vegetative cells by bipolar elongation. Sometimes continuous production of round cells instead of elongation was observed, *i. e.* the chlorelloid morphogenesis persisted. Cells of *Kirchneriella obesa* being *in Chlorella* cycle first flatten, then an indentation gradually extending towards both ends appears. This gradual change results in formation of crescent-shaped cells. Different morphogenetic processes lead from chlorelloid cells to characteristic vegetative forms in *Kirchneriella* and *Ankistrodesmus*, possibly expressing differences in the molecular structure of the cytoplasm. The occurrence of *Chlorella* cycle in both genera points to their ancestral relationship. Factors eliciting the persistence of the *Chlorella* cycle need further study. Mechanisms of division independent of elongation and absence or lasting inhibition respectively of stretching factors may be involved in these processes.

MORPHOGENETICAL ROLE OF NUCLEIC ACIDS IN EARLY ONTOGENESIS OF ASCARIS LUMBRICOIDES VAR. SUIS

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In the present work the DNA changes before and during cleavage were studied by histochemical methods. The material was fixed in Carnoy, dehydrated and embedded in paraffin. Feulgen reaction was performed according to Rafalko. Nucleic acids were demonstrated further with gallocyanine-chrome alum and methyl green-pyronine staining. DNA content of cells from ovaries, oviducts and uteri was determined. The Feulgen staining of the germ cells decreases in the direction from the ovaries to the uteri. No DNA could be demonstrated in the pronuclei of fertilized ova that proved to be Feulgen negative. Ova in early stages of cleavage, *i. e.* containing only few blastomers revealed a cyclic appearance of Feulgen positivity. Cells in telophase or interphase are Feulgen negative. A consistent staining was found, however, in eggs containing a large number of blastomers.

THE EFFECT OF ALKALINE METAL AND ALKALINE EARTH METAL IONS ON THE RHYTHMIC ACTIVITY OF THE LARVAE OF FRESH-WATER MUSSELS

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The effect of various concentrations of salts formed by chloride of some cations fundamentally involved in stimulatory processes, such as K^+, Na^+, Mg^{++} and Ca^{++} on the rhythmic activity of the larvae of fresh-water mussel *(Anodonta cygnea)* was studied. The glochidia obtained from the lamellae of the gill were selectively allotted into groups of 25 each and observed for 10—30 minutes under microscope. The attained activity was recorded by the minute. Each one of the aforesaid ions produced an increase of activity but the concentrations eliciting activity and the time periods of the effect were considerably different. For threshold concentration, the ions may be arranged in the following order: K > Mg > Na > Ca. Taking the time period of activity into consideration, the $1-2 \times 10^{-3}$ M concentration of KCl was found to yield an increased activity lasting over 30 minutes, a phenomenon which cannot be observed in the other ions. The activity increasing effect of NaCl, $CaCl_2$ and $MgCl_2$ takes place in less than 10 minutes at every concentration. The effect of higher concentrations of KCl results in a lasting contraction of the adductor muscles of glochidia. The outstanding effect of potassium ions may be interpreted by their being directly involved in the stimulatory processes of the adductor muscles and in the occurring membrane phenomena.

BIOLOGICAL GRADIENTS AND THE VIRUS-CAUSED DEGENERATION OF LUPINUS LUTEUS L.

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The virus-caused "narrow-leavedness" spreading among lupine species the world over is considered an ecological disease by some research workers. It is accompanied by sterility, which — according to practical experience — does not occur at all or only to a low degree in early sowings (performed about till April 10 in Hungary), but increases proportionately with delaying the sowing time.

In periodical sowing experiments (when sowing is carried out at different dates) during the phase from sowing to flowering, observations were directed to following factors: the accumulated temperature, needed for the given phase, length and number of internods, height of the plant, total nitrogen-content in different stalk heights. For the developmental phase 60 days and an accumulated temperature of about 1050° C, for the start of the cycle about 10° C temperature are required. So the phase-equation given by Lyssenko may be set up for the variety "911 Gyt." of *Lupinus luteus* with a fairly good estimate as follows: $250 + 10.5n = 1050$, where n means the number of days. The developmental state of the plant may be characterized by the number and length of internods, plotting the values of the former on the abscissa and those of latter on the ordinate, according to the following gradational equation: $y = a \cdot x^b$. Here a is the length of the internod from the cotyledon, *i. e.* the starting point of the half-parabola ($x = 0$) expressed by the equation and b indicates the constant which determines the ascent of the parabola referring to the given sowing period. In case of plants grown from sowings with intervals of one week, the value of a increased from 3 to 6, denoting that the first internod developed from the first sowing had a length of 3 mm. whereas that of the 11th phase grew 6 mm. long. During the same time the value of b decreased from 1.89 to 0.98, accordingly the parabola became more and more flat. The distribution of the N-content in the stalk of the plant may be characterized by a similar gradient. Under normal developmental conditions the gradation is portrayed according to the equation: $\log y = \log a + b \cdot \log x$ by a straight line with a slope to the X axis (the directional tangent) determined by b. The phases of later sowings deviate continually from the equation, indicating the successive cessation of the gradation, *i. e.* the vegetative organs (more nodes) became prevalent, the narrow-leavedness disease increases, manifesting itself all the more in many but less organized leaves, shorter peduncles and smaller seed production. The equations pertaining to the different developmental phases change collaterally with the gradation. Therefore the degeneration of the plant and the decrease

of crop may also be understood on ecological-biological basis. Without underrating thei mportance of a virus-caused infection, it must be stressed that its role in the degeneration of lupine is absolutely exaggerated by some research workers.

HISTOCHEMICAL STUDIES ON THE STRUCTURE OF PLANT CELL WALL

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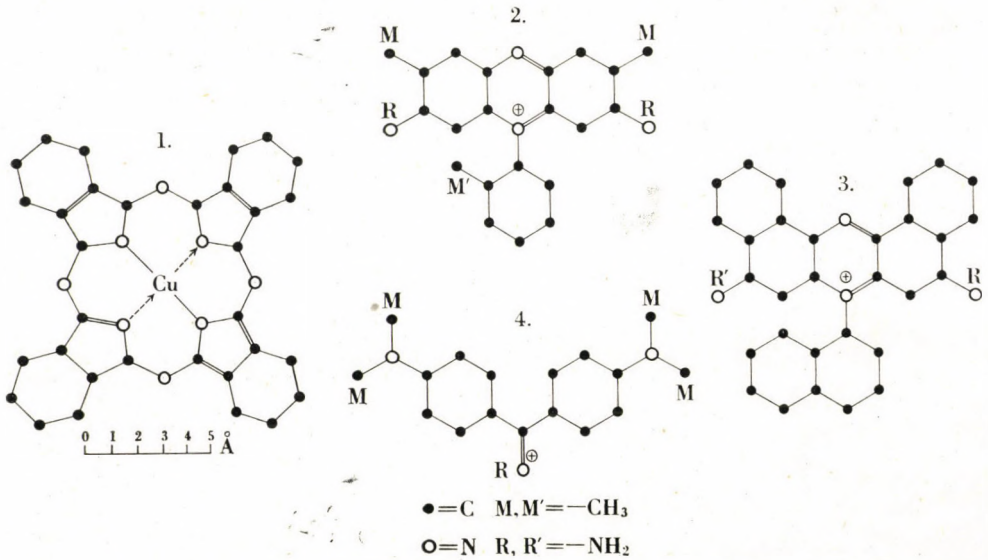
Further studies on the triple stain published earlier by the authors have led to the hypothesis that in the mechanism of staining the size of the molecules plays an important role.

The cellulose cell wall is stained intensive blue by Astrablau. Safranine is bound to the wall less as the process of lignification proceeds. Concurrently, the yellow colour of auramine becomes dominating. Ultimately, the most compact stone cells (in the cortex of *Corylus)* would not get stained even by auramine. The staining reaction is interpreted by the authors as follows: astrablau applied as first stain is incorporated into the cellulose wall with the largest intermicellar spaces. Auramine and safranine are bound to the lignified cell walls; a salt bond is established between the basic N-atoms and the phenolic hydroxyl groups of lignin. The lignin substances deposited in the intermicellar spaces inhibit first the incorporation of the greater safranine molecules: there is virtually no space for safranine in the intermicellar spaces filled with lignin and this results in a negative safranine reaction and a positive auramine reaction respectively (tracheae, composed middle lamellae). To prove the above hypothesis on the same material magdala red was substituted for safranine. It was found that magdala red a substance homologous to safranine but having larger molecules cannot be bound at the heavily lignified places which gave with safranine a weak positive reaction. This indicates that magdala red has even less chance of getting into the lignified intermicellar spaces. Safranine is regarded rather as a fibre dye as in the given combination the most lignified elements (tracheae, tracheids of Gymnosperms) were stained only with auramine. The interpretation of the mechanism of staining merely by chemical terms does not seem justified because the study of the density of ultrastructure of the plant cell wall and its interpretation is possible to some extent by the means of ordinary light microscopes if the size of the dye molecules made allow-



ance for. The molecule models of the dyes applied reflect more or less precisely the respective sizes but it should be noted that only the nucleus of copperphtalocyanine lies in the plane of the paper while the steric structure of the others depends on the direction of the chemical bonds and on the rotation of the various groups.

(1) *Astrablau :* molecular weight unknown, approximately 1000. Only the phtalocyanine nucleus is represented in the figure.

(2) *Safranine :* mixture of M,M and M,M,M'. Cl-salts: $C_{20}H_{19}N_4Cl$ and $C_{21}H_{21}N_4Cl$; the molecular weights are 350.84 and 364.87 resp. Syn: phenosafranine.

(3) *Magdala red :* mixture of R and R,R'. Cl-salts: $C_{30}H_{20}N_3Cl$ and $C_{30}H_{21}Cl$; the molecular weights: 457.97 and 472.95 resp. Syn: naphtosafranine.

(4) *Auramine :* molecular weight 303.827, $C_{17}H_{22}N_3Cl$.

PERIODS OF MAXIMUM GROWTH IN CULTIVATED PLANTS

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The appearance of the periodical maximum is a significant phenomenon in the "great period" (SACHS 1874) of the longitudinal growth of cultivated plants. It is the largest among the differential values of longitudinal growth. Periodic values are less both before and after it. Investigations have shown that all periodic values of growth, and especially the periodic maximum, are of great importance for the determination of the ecological character and requirements of cultivated plants (MÁNDY). Conducting ecological research work, the author had occasion to study the laws of the manifestation of periodical maxima and particularly their percentual share in the total body length. Several considerations argued in favour of weekly measurements, so that the results and findings refer to weekly values. On the basis of these data three plant types can be distinguished: (1) plants growing with moderate vigour in which the periodic maximum does not exceed 20 per cent of total body height, *e. g.* hop, hemp, soybean; (2) plants growing vigorously with maxima exceeding 20 per cent, *e. g.* wheat, barley, oat, maize; (3) plants dependent on ecological influences in which maxima below 20 per cent may be caused by moderate conditions (sunflower) or conditions of higher temperature (muskmelon). It has been found that the periodic maximum is no function of height, its value depends on the growth-rhythm of the vegetative body and is presumably connected with the activity of growth-promoting and growth-inhibiting substances. Ecological changes have no effect on the behaviour of types (1) and (2) values do not, as a rule, exceed 40 per cent of the total height.

CHANGES OF RADIATION-RESISTANCE IN ESCHERICHIA COLI B

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1500 I. U./ml., 2000 I. U./ml. and 2500 I. U./ml. penicillin-resistant strains were produced from *E. coli B* by using SZYBALSKI's gradient plate technique. Multisegmented bacterial filaments were formed under the influence of the penicillin treatment. Radiation sensitivity of the penicillin-untreated and the penicillin-resistant strains has been compared, using X-radiation of high dose-intensity (13.640r/min.).

Measuring the effect of ionizing radiation by percentual survival, radiation resistance of penicillin-resistant strains was significantly higher, than in the strains not treated with penicillin. Radiation resistance was the highest in a strain, which was resistant even to 2500 I. U./ml. penicillin.

HERPETOLOGICAL STUDIES ON THE RIVER TISZA

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Author, as a member of a team of scientists studying the life in the river Tisza, investigates since 1957 the amphibian and reptilian faunas of the Tisza, with special reference to ecological and coenological conditions. From the herpetological point of view, the Tisza is hardly explored yet, evidenced also by the fact that the majority of habitat data proved to be new. The live waters of the Tisza grant a habitat only for the large-bodied, carnivorous *Rana esculenta* L. and *Rana ridibunda* PALL. The two species replace each other in the littoral zone of the upper and lower reaches of the river. The wet, partly wet, and dry habitats of the inundated areas, and the interrelationships of the amphibian species inhabiting them are very interesting. The survival of the amphibian populations is mainly due to the shallow standing waters of the navvy holes. Summer drought has a catastrophic effect on amphibian propagation. The drawing of channels between the navvy holes and the river would, besides increasing the fish-stock, also promote the survival of amphibian larvae. In extremely droughty periods, some newt and frog species retire for a "summer rest" in the deep crevices of the clayey soil. The numbers of individuals of reptilians are much smaller than those of amphibians, owing to the habitats being less favourable for their requirements. In their majority, they are eurytop species, but *Vipera berus* L. and *Lacerta vivipara* JACQU. are stenotop ones. *Vipera berus* L. were found on the Tisza plateaus in still extant forests, sites with a relatively low microclimate. This relict species lives only here, on a clayey soil, in Hungary. The still rarer relict species *Lacerta vivipara* JACQU. was also shown from the Tisza plateaus. In the peat bogs of the Bábtava, it builds its galleries, curiously enough, within the inch-thick sphagnum pads. While the formerly far-ranging *Emys orbicularis* L. is becoming gradually extinct along the Tisza, *Lacerta taurica* PALL., characteristic of the Plains, advances along the dikes of the inundation areas. This is probably brought about by the novel utilization of the alkali (szik) plains: from the areas now flooded to cultivate rice and breed fish, the sand-lizard migrates to the higher, drier, and undisturbed sites, thus also to dams and levees.

STUDIES ON CA-REGULATION IN OSTEICHTHYES

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The Ca-metabolism of *Cyprinus carpio* and its dependency on Ca-content of the environment were studied in chronic experiments. In environments poor in calcium (hypocalcic) an initial fast drop and subsequent normalization of the serum Ca level was observed. Environments rich in calcium (hypercalcic) elicited a slow increase of serum Ca level. The experiments show that serum Ca level is dependent not only on the milieu. Present findings favour the assumption of the existence of an active control mechanism which can compensate the drop of serum Ca level evoked by EDTA-2Na. Different Ca uptake from the environment by different tissues and lack of parallel changes in tissue and serum Ca level point to a regulation localized in the tissues.

DISTRIBUTION OF CADMIUM IN THE ORGANS OF FRESH-WATER MUSSEL WHEN PERIODIC ACTIVITY IS CHANGED BY $CdCl_2$

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Previous studies have shown that periodic activity ensured by the function of a fresh-water mussel's adductor muscle can be characteristically changed if $CdCl_2$ is added to the water surrounding the animal. Owing to this effect, the lasting state of activity will be substituted by the alternation of short (2—5 hrs) periods of activity and rest. As the activity could not be reestablished by simple washing and as the property of mussels to store or bind a number of

substances from the surrounding water is well-known (GALTSOFF), it seemed necessary to investigate whether Cd capable of influencing so significantly the animal's physiological function accumulates and to what extent in the different organs of the mussel under the given experimental conditions. Studies with the method of emission spectral analysis have revealed that the different organs of the animal after being kept in water containing $CdCl_2$ and after being washed for three hours may be arranged in the following order of Cd content: gills > mantle > adductor muscles > lymph. In these investigations the Cd-content of the mantle and that of the syphon part of the mantle as correlated to each other were given special attention since the latter region plays an outstanding role in the regulation of activity, but no significant difference was found. This points to the fact that the distribution ratio of Cd in the organs is not correlated with the functional role of Cd. In other words, for the greater portion of Cd not "binding" but rather "storing" occurs.

EFFECT OF COLCHICIN AND ULTRAVIOLET LIGHT ON TETRAHYMENA PYRIFORMIS

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Authors investigated the effect of different concentrations of colchicin and different duration of UV irradiation on *Tetrahymena pyriformis*. Mass cultures were bred and colchicin added to the cultures in such doses as to obtain concentrations of 0.05, 0.1, 0.2, 0.5, and 1.0 g. per 100 ml. of pepton medium. After this treatment 200 animals removed from each flask and their length and width were determined. All animals grown in the presence of colchicin differed in their length and width from the control specimens. All differences proved to be statistically significant. In the second part of the experiments the authors bred mass cultures which were irradiated for 10, 20, 30, 40, 60, minutes by UV light. All UV light treated animals having been measured in their length and width proved to be smaller than the control specimens. The differences were significant here too. These results confirmed the authors' earlier findings that the changes in form appear on account of changes of metabolism, occurring as a result of mental conditions. These changes as pointed out in an earlier communication appear as changes in body dimensions.

NITROGEN AND PHOSPHORUS ASSIMILATION IN VARIOUS DEVELOPMENTAL STAGES OF RICE

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Nitrogen and phosphorus assimilation in rice (Dunghan Shali) was investigated by leaf analysis in optimum conditions of cultivation on grassland clay soil not favouring the incidence of diseases. Samples were taken on 12 instances during the growing season. It has been established that in the case of 20 cm. mean flooding only 3 well developed leaves can be found on the rice shoots after shooting. The lower leaves being covered by water perish and this leads to crop failure. Leaf analysis at various insertion levels has shown that nitrogen and phosphorus contents decrease from the top of the plant downwards and exhibit maximum values at two developmental stages: in tillering and in flowering. From the trends of the curves for N and P contents conclusions can be drawn as to the nutritional status of the plants and their N and P requirements respectively. In the case of optimum supply with nutrients the curves for the 3 leaf insertions run more or less parallel as shown in most experiments under the present study. Where the N curves of the lower and upper leaves significantly deviate from the parallel we are apparently facing nitrogen deficiency. This conclusion is supported by the low total nitrogen content of the grain in the later developmental stages. Maxima of phosphorus content were found at all three insertions in tillering and flowering. It is very likely from this finding

that the phosphorus supply was satisfactory during the whole growing season. This is easily seen from the N : P ratio (6.1 in the average of 3 insertion levels). The phosphorus content found in rice grown on lime-deficient alkali (szik) soils promoting disease development was far below of this figure. It might be supposed that nitrogen abundance, as a factor known to promote disease development, is actually comparative phosphorus deficiency. In our opinion it would be more correct to claim P-deficiency in connection with rice diseases because this would point to the necessity of supplying these rice plants with available phosphorus, *e. g.* phosphorus supplied by foliar application.

THE EFFECT OF SEROTONIN AND ITS RELATED COMPOUNDS AS WELL AS CATECHOLAMINES ON THE RHYTHMIC ACTIVITY OF THE LARVAE OF FRESH-WATER MUSSEL

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Proceeding from the supposition that in the stimulatory processes of molluscs serotonin plays the part of a specific humoral substance (Welsh, Koshtoyants), while catecholamines have no such role, the authors investigated the effect of the above substances on the rhythmic activity of the glochidia of the fresh-water mussel *(Anodonta cygnea)*. Serotonin, tryptophan and 5-hydroxytryptophan as well as adrenaline, noradrenaline and tyramine were found to produce an equally significant initial increase in activity (lasting 3—5 min.) in concentrations as low as 0.1—1 μg./ml. Tryptamine proved to be the most active. Upon its application, a striking increase in activity lasting over ten minutes was observed. Catecholamines in low concentration do not give rise to a lasting increase in activity, while higher concentrations (100 μg/.ml.) have an inhibitory effect. The authors assume that these substances of proved activity directly influence the function of the embryonal adductor muscle. Experimental results suggest that at the glochidial phase of ontogeny, tryptamine which is close to serotonine plays an important role in the stimulatory processes of bivalves, while serotonin itself has as yet no activating effect at this phase. The inhibitory effect of catecholamines arising only in a higher concentration can hardly be regarded as physiological.

COMPARATIVE EXAMINATIONS OF THE STRUCTURE OF THE CILIARY GANGLION

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The ciliary ganglion— as regards its structural and nerve connection — is very variable in the different classes of the vertebrates and differences may be found also among the different species. This latter is mainly caused by differences in age of the animals examined.

The ciliary ganglion of the fishes joins with the trigeminal ganglion group and has a cerebrospinal character consisting of uni- or bipolar cells. In the frog the ganglion is entirely different. Its multipolar cells possess a similar character to most of the sympathetic ganglia in general. Of the reptiles: lizards and snakes have similar ciliary ganglia to those of the bird, consisting only of unipolar cells and having one root originating from the oculomotorius. The ciliary ganglion accordingly belongs here merely to the parasympathetic system. The structure of the ciliary ganglion in turtles is, however, identical with that of the frog ganglion containing nothing but multipolar cells. Mammals have mixed ganglia with 3 roots (trigeminus, oculomotorius, sympathicus). In this case the cells are multipolar and very variable as to form and size of the different species. Dogs, cattle, horses, chimpanzees and humans are characterized by window-like cells whose dendrites are united quite near the cell bodies forming holes of different size. This type was never found in the ciliary ganglion of *Erinaceus*, *Talpa*, *Lepus*, *Citellus*, *Mus*, *Rattus*, *Cavia*, *Cricetus*, *Felis*, *Ovis* and *Capra*.

No neurosecretion is shown in the cells of the ciliary ganglia by the Gomori method, but very different forms of synapses are found in the cells or near to them (Cauna method). In frogs, turtles and birds fine fibres forming pericellular capsules are present as synapses. In mammals beside the pericellular fibres end-bulbs are found as synapses in considerable number. The forms of the synapses can be demonstrated also by the cholinesterase activity in the ciliary ganglion (Koelle—Friedenwald method).

The nerve cells of the young animals are extremely compact, the processes of the cell bodies are hardly discernible and synapses are never seen. The ciliary ganglia of the old animals are characterized by the great amount of synapses.

The differences shown in the structure and nerve connection of the ciliary ganglion may be related to the innervation of the optic layers.

THE EFFECT OF CARBON DIOXIDE AT STUNNING EXPERIMENTS IN ANIMALS

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In 1961 the effect of carbon dioxide (CO_2) was examined on slaughter animals by the aid of a prototype stunning equipment designed by the Hungarian Meat Research Institute. About 10,000 hogs and 16 sheep were driven into the stunning room filled with the mixture of carbon dioxide and air of various concentrations. The results of the experiments are as follows: the effect of CO_2 and its different degrees of efficiency are determined by the gas concentration (time ratio (cc)t). CO_2 with a low concentration (10 to 20 percent by volume) had an anaesthetic effect on the animals, but the breathing and vasomotoric centres were violently irritated. Medium concentrations (30 to 50 percent by volume) induced serious dyspnoea and motoric agitation. Respiration increased to 50 and pulse rate even to 200, *i. e.* to the threefold of normal, in this condition. In very high CO_2 concentrations (70 to 78 percent by volume) the animals were stunned after 20 to 40 sec. Their reflexes (the "blinck" also) failed, the respiration became periodical, heavy, KUSSMAUL-type, its rate decreased to 2 to 3, and the pulse rate to 10 to 15, *i. e.* to the $^1/_5$ to $^1/_6$ of normal, but the remaining life-functions became more vigorous. The animals awakened from this deep narcotic state in 2 to 3 minutes on fresh air, and after further 5 to 6 minutes they stood up. Deleterious after-effects were not observed even after 24 hours. New results: the animals endure much higher concentrations of CO_2 according to the present experiments than stated in the literature till now with animals as well as with man. The CO_2 in high concentration (65—78 percent by volume) has a stunning effect and all stages of narcosis may be induced in the experimental animals, so as I. analgesia, II. stadium excitationis, III. stad. tolerantiae s. narcoticum, IV. stad. paralyticum s. asphycticum. These are the results of the special narcotic effect of CO_2 and of the anoxia of the organism. CO_2 death is not the result of the paralysis of the breathing centre, but of the gradually developing total anoxia, so this is a respiratory-toxic death. Prolonged CO_2 effect causes often subendocardial extravasatus in the myocardium, and plethora, or blood stagnation respectively in the liver and mesenteric veins.

HEREDITARY AND ENVIRONMENTAL FACTORS IN THE INCIDENCE OF CONGENITAL HIP LUXATION

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Opinions about the origin of congenital hip luxation widely differ. Some workers suppose a genetic malformation as the basis of this disease, while others suggest that there is a change in the metabolism of the embryo which leads to the deficient development of the bones.

Authors examined 100 families in which hip luxation occurred, and demonstrated that the 100 probandi have had 16 brothers and sisters (*i. e.* 20.5% of the brothers) and 29 other

relatives suffering from congenital hip luxation. The family members had other developmental abnormalities in 23 further cases. On the other hand the families of children born with hip luxation lived in significantly worse social condition than the average of this country. Probably the deficient vitamin uptake furthers the development of congenital hip luxation. Authors suppose therefore that a sex-limited hereditary property is responsible for this abnormality, but luxation becomes manifest only when environmental conditions promote its development. It is presumable that with a further rise in living standards would decrease the incidence of congenital hip luxation.

CONTRIBUTIONS TO THE SEPARABILITY OF THE CHOLINESTERASE ACTIVITY OF MYOSIN

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Myosin free from actin was prepared from the striated muscle of rabbit according to Portzehl, Schramm and Weber and by extraction of 0.2 M $MgCl_2$ solution respectively. The myosin preparations reprecipitated three times were subjected to heat-treatment according to Locker on 53° C at pH 6.2 for 5 minutes.

Under the influence of heat-treatment the myosin was partially coagulated and depolymerized. The cholinesterase activity remained unchanged as related to the starting-point. The coagulated protein contained 82 to 88 per cent of the total quantity of protein and 50 to 60 per cent of the total cholinesterase activity. The specific activity of the fraction remaining in the solution increased 2 to 3 times. Further augmentation of the specific activity was observed when the fraction remaining in the solution was dialyzed with distilled water at 0° for two hours and the precipitate (P_1) obtained after centrifugation solved in 0.5 M KCl. The cholinesterase activity was held practically by the P_1. After further heat-treatment of P_1 and repetition of dialysis the specific activity of the P_2 fraction produced in this way was 15—25 itmes higher than the original activity of the myosin. It is remarkable that the cholinesterase activity is always a property of the P fractions being myosin-like as to solubility. Locker could find desaminase activity after heat-treatment of P_1 only in the supernatant of P_2.

CONTRIBUTIONS TO THE FLORA OF GYÖMRŐ AND ITS ENVIRONMENT

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The author proceeded to study the flora of the village Gyömrő and its environment in 1960. The plant material of the different areas was systematically gathered in and the soil conditions of the sample plots were registered on the map available. In the first place it was aimed at to mark the boundaries and to survey those tracts which are still covered with the original vegetation but will soon loose it, due to changes in the branches of cultivation.

The village Gyömrő lies about 27 kilometres eastwards from Budapest where the southern foothills of the Cserhátalja adjoin the Hungarian Great Plain (Alföld). Its flora occupies the area in which the Cserhát-Börzsöny floristic district of the Matricum is contiguous to the Praematricum of the Eupannonicum. Pedologically it shows a double character too. Its northern part belongs to the hilly land of Gödöllő whilst the southern part to the sand ridge lying between the rivers Danube and Tisza. Due to this double nature the flora of the village (having a relatively small area of about 2600 hectares) may be divided as follows. On the northern side, in the highest situated part of the whole area and adjacent to the village Mende, characteristic floral elements of the Cserhát and Börzsöny mountains occur *e. g. Crataegus monogyna, Campanula bononiensis, C. glomerata, C. rotundifolia, Adonis vernalis, Ranunculus illyricus, Thalichratum minus, Agrimonia eupatoria, Rosa gallica*, etc. Conversely, the southern borderland of the village shows conspicuous features of the Great Plain and consequently also a flora typical of the Praematricum vegetation. From the species very characteristic especially of the so-called "Halas" ditch running in the middle of village as well as of some meadows

belonging here, the following should be mentioned: *Solidago gigantea*, *Mentha aquatica*, *Seratula tinctoria*, *Myosotis palustris*, *Symphytum officinale*, *Gnaphalium luteo-album*, etc.

In the area of the village a centrally situated marshy meadow of about 5.8 to 8.7 hectares and of quasi intermediate position is to be found where floral elements of both floristic regions, *e. g. Pedicularis palustris*, *Eriophorum angustifolium*, and several species of Ranunculaceae appear.

RESISTANCE OF CERTAIN ANIMALS TO ATHEROSCLEROSIS

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It was not the intent here to produce experimental atherosclerosis in animals and promote or retard its development with some test substance, but to discover the cause of natural (biological) resistance in those aged, mainly carnivorous, animals which were suffering from hyperlipaemia and hypercholesterolaemia without the appearance of atheromatous plaques. The rook *(Corvus frugilegus)* was found to be best suited for the experiments; this animal feeds chiefly on flesh in summer, and sometimes reaches the age of a hundred years. The sera of 14 male birds of about 80 years of age were analysed; not only the level of total lipids but also that of cholesterol and phospholipids was determined, and — by means of paper electrophoresis — the distribution of the protein and lipoprotein fractions was established as well. Twenty-eight 2-year old Leghorn cocks served as control; 2 g. of cholesterol was admixed to their daily food during a hundred days.

The blood drawn from the rooks appeared lipaemic already at first sight. Analysis revealed 1221 ($\pm$230) mg.% of total lipids, 187 ($\pm$14) mg.% of cholesterol and 242 ($\pm$38) mg.% of phospholipids. The aorta, however, displayed no atheromatous change. The serum of the control animals contained 260 ($\pm$66) mg.% of total lipids, 96 ($\pm$21) mg.% of cholesterol and 94 ($\pm$8) mg. %of phospholipids. The histological picture showed no signs of atherosclerosis. At a total-lipid level of 1040 ($\pm$280) mg.%, the concentration of cholesterol was 386 ($\pm$92) mg.% and that of phospholipids 240 ($\pm$88) mg.% in the cholesterolsclerotic cocks. Widespread atheromatous plaques were observed in the aorta. In the rooks, an increase in the number of lipoprotein fractions with high electrophoretic mobility was found. The normal serum values of the old individuals pointed to hyperlipaemia and hypercholesterolaemia, although — in contradistinction to the control cocks — no atheromatous plaques had developed. This was obviously due to the coincidental existence of hyperphospholipaemia which may have inhibited the atherogenetic action of hypercholesterolaemia. The quotient C/P was less than the unit, and so was the ratio of the lipoproteins β/α.

Tissue metabolism shows a pathologic change in atherosclerosis, and the power to synthetize phospholipids seems to be a significant factor of natural resistance.

SEPARATION OF SOME BIOLOGICALLY ACTIVE SUBSTANCES BY THIN LAYER CHROMATOGRAPHY

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Silica gel prepared from Hungarian raw material ("Szilikagel V") and a mixture of silica gel and Al_2O_3 ("Szialgel 47") was used for experiments carried out by thin layer chromatography, the most up-to-date chromatographic procedure. Equipment produced by the firm Desaga was used for the final preparation of the layer. We succeeded in separating the stereo isomer farnesols deeply involved in the biosynthesis of terpenoids by the use of chromatography in benzol containing 5 per cent ethylacetate. The farnesols are known to have a juvenilizing hormonal effect. Their detection on the chromatograms were carried out by spraying with 1 per cent vanillin or 0.5 per cent anise-aldehyde in concentrated sulphuric acid. The farnesols gave a characteristic dark purple colour. The compounds present in the drug of *Chrysanthemum cinerariaefolium* which exhibit insecticidal effects were sprayed in this case by 1 per cent vanil-

lin in concentrated sulphuric acid. This reagent is much more sensitive than the reagents applied by STAHL ($SbCl_3$, $SbCl_5$, KJ-J_2, etc.). Gibberellic acid accepted now to have an important role in plant life was run in a 1 : 1 mixture of acetone and methyl alcohol. As reagent was used concentrated sulphuric acid. In the 1—100 range a semiquantitative evaluation is possible. For the separation of *Colchicum* alcaloids widely used in the induction of polyploidy and in the chemotherapy of cancer, benzol containing methanol, chloroform and 5 per cent ethylacetate was used. The chromatograms were sprayed with 1 per cent vanillin in concentrated sulphuric acid, respectively with the Dragendorff reagent.

PHOSPHORUS DEFICIENCY IN RICE INDUCED BY MICROBIOLOGICAL REDUCTION

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In soils periodically flooded with water the anaerobic conditions and the fermentation of cellulose-containing plant residues induce microbiological reductive processes. Of these the sulfate reduction and its pedological, physiological and industrial effects were studied more thoroughly. Phosphate reduction occurring in the soil is also highly important for the nutrition of the rice plant. Under anaerobic conditions some bacteria utilize the H_2PO^--ion as an oxygen source which is reduced to form PH_3. Phosphate reduction is carried out not by specific phosphate reducing bacteria but by butyric acid fermenter microorganisms (Clostridia) decomposing the organic matter of the constantly decaying rice roots and by coli-bacteria *(Escherichia coli)* rapidly in the environment. The reducing H_2PO_4-ion is the product of microbial degradation processes or of the breakdown of organic substances rich in phosphoric acid. If the soil is not covered by a water layer but still saturated with water the PH_3 produced is released through the openings of the drying soil and oxidized in the air. Phosphate reduction can result in rice fields in phosphorus deficiency leading to a delayed ripening of the crop. The grains are greenish in colour under these conditions. This is a serious problem as early ripening is extremly important for rice growing in Hungary. The beneficial effect of KH_2PO_4 applied during seed setting has been demonstrated in field experiments. It was found that with suitable phosphorus supply the rice reached the stage of ripening 6 days earlier than in the control.

ALGAL BLOOM, FISH DECAY AND SELF-CLARIFICATION OF PONDS

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Experts of fish-breeding have turned their attention long ago to the connection of rapid fish decay and algal bloom. As a result of microbiological activity a sulphide-containing mud piles up on the bottom of fish ponds of acidic soil. If temperature and atmospheric pressure decrease, hydrogen sulphide gets released from the mud layer. The initial low concentration of hydrogen sulphide stimulates the respiration of algae, their assimilation stops or decreases to a minimal measure. In algal cells gas vacuoles develop, due to this and to dissimilation the specific weight of algae diminishes, they ascend and form a continuous layer on the water surface. This is the so-called algal bloom. Hydrogen sulphide kills more and more algae and the aerobic bacteria decomposing them proliferate to an extremly high degree. The still alive and increasingly respirating algal layer together with billions of aerobian bacteria form on the water-surface a continuous filter which consumes enormous quantities of oxygen and prohibits the access of this element to the water. As oxygen production of algae ceases and they themselves become oxygen consumers and, on the other hand, the penetration of atmospheric oxygen is checked, a considerable oxygen deficiency arises. The amount of hydrogen sulphide grows to a toxic degree. Increasing hydrogen suphide kills all water organisms containing ferrous enzymes and unable to escape. Perished algae settle on the bottom, therefore the water becomes entirely clear and clean; this is the self-clarification of ponds.

ON ENZYMATIC OXIDATION OF REDUCED RIBONUCLEASE

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It is known from the work of ANFINSEN *et al.*, that bovine pancreatic ribonuclease is easily reducible by various thiol compounds. After removing the reducing agent, the reduced inactive enzyme is reoxidizable at slightly alkaline pH values, at room temperature, by atmospheric oxygen. Complete reoxidation has been observed in about 20 hours, and the enzyme regained 80 to 100% of its original activity. In the present experiments, reduction was carried out by the method of WHITE, while ribonuclease activity was measured according to SCHUCHER and HOKIN. A heat-labile, undialyzable factor has ben observed in pigeon pancreas, which catalyzes the reoxidation and reactivation process. An extract of acetone-dry pigeon pancreas completed the reoxidation within 30—60 minutes. The catalytic factor seems to be organ-specific, but shows no species-specificity. The possible role of this factor in the last steps of ribonuclease formation *in vivo*, is discussed.

THE ROLE OF GLIA CELLS IN THE PROCESS OF NEUROSECRETION AND EPENDYMOSECRETION

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Around the secretory cells of the hypothalamus, below the ependyma carrying Gomori-positive secretion, as well as partially in the plexus chorioideus there are glia cells containing Gomori-positive granules in abundance. The cells surround the vessels in a great number. Granules were also observed in the endothelial cells of the vessels. Likewise round, Gomori-positive cells could be found in the lumen of the vessels though their character is not established so far.

On the surface of the plexus chorioideus macrophage-like Gomori-positive cells were observed, also some round, Gomori-positive cells containing granules in the lumen of the ventricle, in the cerebrospinal fluid.

A relation is supposed to exist between the hypothalamic neurosecretion, the Gomori-positive secretion of the ependyma and the plexus chorioideus on the one hand and between the glia cells and Gomori-positive cells of blood and liquor on the other. Presumably the glia cells play a role in the transportation of Gomori-positive material from the nerve tissue to the blood and the cerebrospinal fluid.

ANALYSIS OF AMINO ACIDS IN THE BLEEDING SAP OF VARIOUS RICE VARIETIES

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It has been shown in previous studies that root metabolism largely depends on the oxygen supply of the environment. Therefore, it seemed interesting to conduct a comparative study of the activity of roots in the irrigated rice variety Dunghan Shali and that of the "dry rice" Pallagi-73. Under field conditions bleeding sap was collected and its free amino acid content determined by paper chromatography. It has been shown that the composition of the amino acid content of the bleeding sap largely depends on the oxygen supply of the root and on the water cover. In the bleeding sap of Dunghan Shali alanine was found consistently to be the major free amino acid while in that of Pallagi-73 asparagine and aspartic acid dominated. It should be stressed that the cultivation of the Pallagi-73 rice in conditions of flooding results in an amino acid composition of the bleeding sap which is similar to that of the other varieties. The one-sited increase in alanine takes place in the root; it is not characteristic of the shoot, irrespective of the method of cultivation. This is easy to understand as the alanine $\rightleftarrows$ glutamic acid transamination system is highly active in the rice. It might be concluded from these results that the transformation of N-compounds in the root system and their transport is highly dependent on environmental factors, among others on the oxygen supply. Under conditions of flooding the oxygen supply of the root system is not satisfactory and this favours alanine synthesis.

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