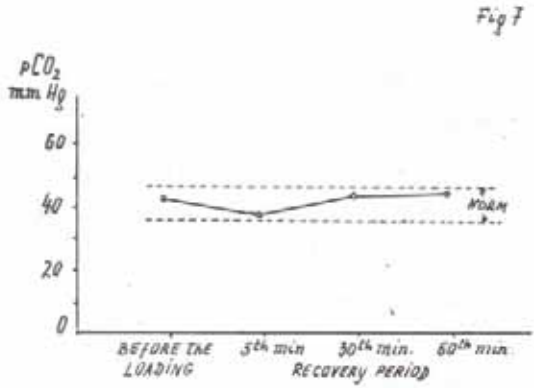

Fig. 7. pCO_2 changes during recovery period

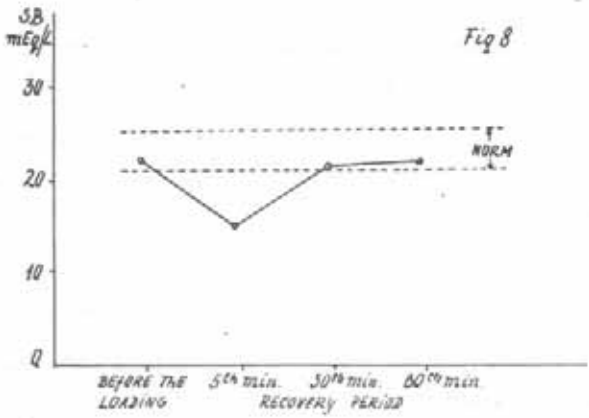

Fig. 8. Standard bicarbonate /SB/ changes during recovery period

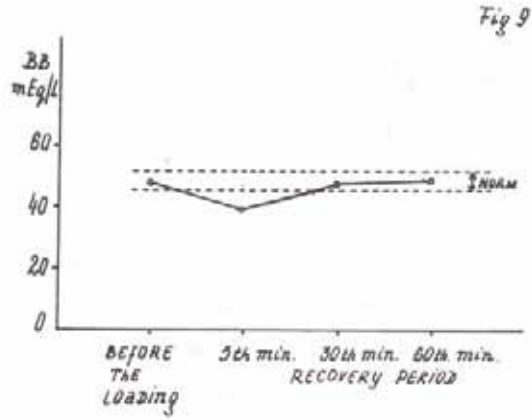

Fig. 9. Buffer bases /BB/ changes during recovery period

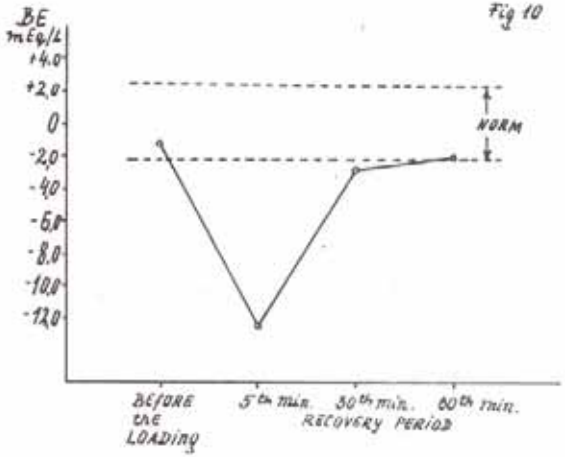

Fig. 10. Bases excess /BE/ changes during recovery period

most limit of the norm is observed on the 30-th minute.

CONCLUSIONS:

1. During interval exercises with increasing in intensity but decreasing in time working periods, an increase of O_2 consumption is observed in each consecutive working period.

2. Two types of changes in lactate concentrations were established during interval work: I - with an acute increase on the 5th minute of the recovery, and delayed return to the norm on the 30th minute of the recovery, and II - with slighter increase on the 5th minute and normal recovery on the 30-th minute. The obtained data warrant the assumption that the evolution of the changes in the second group point to a greater functional capacity of the organism.

3. Inversely proportional correlations at varying degree of correlation exist between lactate blood concentration and O_2 consumption for the working periods, respectively the overall O_2 consumption, for both groups.

4. A non-compensated metabolic acidosis is observed on the 5th minute after exercise, turning into a partially compensated one on the 30-th minute of the recovery period.

BIOLOGICAL TRAINING AND RECOVERY AFTER EFFORT IN HIGH PERFORMANCE ATHLETES

I. Dragan - Romania

Sports medicine is ever more implicated in modern training. Biological training and recovery after effort represent only two possibilities, lately more and more appreciated, for the improvement of sports results, for the prevention of some troubles or diseases, for the increase of the sanitary level of athletes.

Biological training for competition represents several natural and artificial means (training conditions, living conditions, diet, kinesitherapy and physiobalneotherapy, psychotherapy, pharmacology, etc) used for the improvement of the work capacity (ergotrophy effect) as a result of the effect exerted on some parameters included in the functional circuit of the body.

Recovery, rebuilding of biological equilibrium or biological reconditioning after exertion, represent a combination of natural or artificial factors (stereotype of recovery), deriving from the external or internal milieu, used rationally in order to accelerate the processes of the restoration of the body homeostasis at the pre-effort level (it means elective action towards the most implicated biological parameters in a specific effort) and even to exceed this level ("overcompensation"). A practical solution of these two aspects requires elucidation of some theoretical problems, among which the most important seem to be the followings:

a). Physical potential (power)-B. Eriksson, Sweden

Energy liberation

-Aerobic - VO_2 max./Kg

-Anaerobic - O_2 debt

Neuro-muscular functions

- Muscular resistance - isometric and isotonic
- Technics of sports - coordination

Psychological factors

- Motivation (spirit of fight)
- Behaviour (characteristics of the nervous system)

b). Limitative factors of the muscular performance

- appearance and development of fatigue
- acidity and limitation of the O_2 debt increase

- exhaustion of muscular glucose reserves
- excessive production of heat

c). Basic factors implicated in fatigue

- high level of lactic acid
- metabolic acidity
- decrease of blood glucose
- central nervous factor and psychical sphere
- endocrine and vegetative sphere

d). Can performance be increased by physiological means

Yes! By scientific training (including biological training and recovery after effort) and sports life which produce:

- increase in mechanical efficiency of muscles (anaerobic power)
- cardio-respiratory and metabolic improvement (aerobic power)
- increase of the muscle mass
- improvement of blood composition
- improvement of functional adaptation of the body
- neuro-psychical training (which avoids pathological tiredness)
- motivation for higher sports results and improved health state

e. Can some pharmacological or other means improve performance

- local or general anti-inflammatory drugs or analgetics, "pain killers"
- syntetical androgenous hormones(anabolics) which can improve women performance by 80-85% in comparison with men; in men they can also increase the power and bulk of muscles
- women hormones(Primolut N, Lyndiol) changing the menstrual

cycle might favour performance because we know that before the cycle and during the first 1-2 days, some female athletes have a decrease of the output

- alkaline diet (which combats metabolic acidity)
- O_2 which might accelerate the O_2 debt compensation, essential metabolites: vitamins, mineral salts, glucose, ATP, amino-acids, coffee)
- peripheral arterial vasodilators (pharmacological, physical)
- suggestion and hypnosis
- drugs which fight against psychological tiredness

The last two means are actually forbidden, being considered as doping.

A. The basic means of biological training

- Rational training (volume, intensity, complexity)
- Improvement of the health state and work capacity
- Rational food and sports life
- Psychological preparation (motivation, mobilization)
- Warming up and massage (stimulating)
- Training at medium altitude 3-4 weeks, competing either in the first 48 h or after 12-14 days when athletes get down on level ground
- Pharmacological means:

  Atépadene; Supertonic; ATP 30 mg + 50 mg B_6 + 1 g glucose; Prevalon (ATP, glutamine, B_1, B_6, B_{12}, C, Mg ascorbate, arginine aspartate); B; C; glucose; Farmacole (glucose, vit.C, ATP, K and Mg aspartates, coffeine, t^{ra} colla); an East Germany product composed of:glucose 1 g; 300 mg and K aspartates; 500 mg C vitamin; 50 mg B_6 vitamin; 1 g t^{ra} colla; 250 mg ceffeine.

These substances might stimulate the synthesis of hormones, enzymes, and vitamins (biocatalyzers); have liver protecting and bioenergetic effects, stimulating endocrine-metabolic nutrition and trophicity and liberating -SH groups, which are bioenergetic.

B. Recovery after effort

1. Theoretical basis

- Recovery and effort are component parts of athletic training

- Recovery is addressed to a healthy sportsman (different from rehabilitation)

- Recovery, natural, spontaneous process

- Recovery must be practical (recovery stereotype)

- Recovery is addressed to the most solicitated parameters of the body during exertion (neuro-psychic, metabolic, neuro-muscular, cardio-respiratory, endocrine-vegetative)

- Recovery (trophotropism) is closely correlated with biological training (ergotropism)

- Recovery depends on the competition (one day or more), after competition, after a day, after a week, after a year or an olympic cycle)

- Pharmacological recovery must be considered as an exceptional method, imposed by medical reasons

- Recovery has a general part, common to all sports and a special part, having a specificity for individual sports disciplines

- Daily recovery in a close correlation with the daily rhythm"

2. Practical means in recovery

a). Neuro-psychic sphere

- Psychotherapy

- Autogenous training; Yoga
- Warm hydrotherapy
- Massage and automassage
- Oxygenization and aeroionization
- Passive(sleep) and active rest
- Medicines: glucose, Ph, B vitamins, amino acids such as lecithin, glutamic acid, glycocolle, Mg, sedatives

b). Neuro-muscular sphere

- Warm hydrotherapy; physiotherapy; steam bath
- Autogenous training; Yoga
- Massage and automassage
- Active and passive rest
- Medicines: glucose, ATP, Ph, Na, K, Mg, C, B, E vitamins, drugs liberating -Sh groups like glutathione or folcysteine, muscle relaxants like paraflex, midocalm, neostigmine, clorzoxazon, muskel-trankopal, etc.

c) Endocrine-vegetative and metabolic sphere

- Oxygenization and neuro-muscular relaxation
- Hydroelectrolitics re-equilibrium
- Psychotherapy
- Massage and automassage
- Active rest at law altitude
- Medicines: non-hormones anabolics, aminoacids, vitamins, mineral salts

d) Cardio-respiratory and metabolic sphere

- Oxygenization and aeroionization
- Hydroelectrolitics re-equilibrium
- Warm hydrotherapy, steam bath, massage and automassage
- Autogenous training; Yoga; passive and active rest
- Diet(alkaline, hydroglucose)

- Medicines: Na, K, ATP, glucose, espartates, lecithine, lysine, vitamins C, B, E, Biotone surrênal, Sabortonic, Ascortonyl, Uvit B, Surelen, Ultra-K

All these means afford possibilities to accelerate recovery after effort and are not a substitute of the current means of athletic training.

C O N C L U S I O N S

Biological training and recovery after effort are two processes which interpenetrate and though they have different criteria, aims and means, both are component parts of athletic training.

These two processes follow the physiological rules of athletic training.

The knowledge of these two processes is indispensable for coaches and athletes who strive for high performances.

Sports medicine has objective possibilities to appreciate these two processes.

The efficiency of these processes can be used not only in sports performance but especially in the everyday life of the contemporary society, for high output and high sanitary standard.

CHANGES IN SOME ANTHROPOMETRIC, FUNCTIONAL AND SPORTS TECHNICAL INDICES IN YOUNG FIELD-AND-TRACK ATHLETES SUBJECT TO HEAVY TRAINING

S.Savov, I.Iliev - Bulgaria

High sports achievements are possible only after continuous training where maximum loads play a decisive part. Their dosage is a difficult task and it is determined by the specific character of the event and by the age peculiarities of the organism.

Field-and-track events with their numerous varieties require high coordination skills, explosive power and capacity for continuous work. Proceeding from these requirements, the training of the future field-and-track athletes has to be scientifically substantiated and based on the dynamic follow-up of some basic morphological, physiological and sports technical indices.

Material and method

Our observations include 24 boys and 29 girls, pupils from the Unified Sports School - Plovdiv, divided into three groups according to sex during the school years 1972/1973 and 1973/1974.

The following anthropometric indices have been followed up: height, sciatic height, biacromial diameter, transverse diameter of the thorax, bicrystal diameter, anterior-posterior diameter of the thorax, chest, upper-arm and femur measurements. The measurements were taken by means of an anthropometer Martin type within 1 mm. for the longitudinal indices. The vital capacity was recorded spirographically (Samardzhiev spirometer). The spiroergometric investigations were carried out with a Veloergometer Zimmerman and Spirolyt II - German Democratic Republic. The method of a stepwise load increase was used.

The children in the separate groups were selected according to the norms accepted for 1971 and are trained in boarding-house conditions. The intensity of the training exercises is considered to be average. Training is carried out under the supervision of qualified teachers with adequate facilities and proper alimentation and recovery.

Results and discussion

The height data from the separate groups - boys and girls are above and below the uppermost limit of the range x - I s (compared with the data for the Plovdiv children - Department of Anatomy

- Higher Medical Institute Plovdiv, 1969).

If we consider the rate of growth during the observation, it will be noticed that there is a marked growth in boys between 12-13 followed by a lagging behind as compared to that of the control group. This tendency is especially pronounced in girls - Table 1

Age period	In Plovdiv		Unified Sports School	
	boys	girls	boys	girls
12 - 13	6.9	4.9	7.4	3.3
13 - 14	6.9	2.7	5.6	2.6
14 - 15	5.5	2.2	4.6	1.1
15 - 16	2.9	1.5	3.0	0.3

The weight in the separate groups is within the limits of the mean values characteristic of the Plovdiv children.

The values of the remaining anthropometric indices (sciatic height, biacromial diameter etc.) are at the uppermost limit within the range x - I s. The annual increase of the same values is within the limits of the mean values characteristic of the age.

The vital capacity of most of the field-and-track athletes (boys and girls) significantly exceeds the values of the Plovdiv children and the range x - I s.). The same holds true for its annual growth.

The analysis of the physiological indices shows that:

The values of the systolic and diastolic blood pressure are within normal limits for these ages. During the observation period, it did not show a reliable lowering characteristic of the athletic training effect, while the pulse pressure in all groups displayed a tendency to increase.

During Veloergometer exercises, the pulse pressure (initial

values) lowers considerably parallel to growth and conditioning level. The maximum pulse values are close to each other for all children being somewhat lower during the year of initial training. Following up the recovery period (2,3 and 5 minutes) we can notice that with the progress of fitness, the recovery becomes quicker.

The ergometric work capacity (W; W: k.t.) shows the following peculiarities:

The absolute work capacity increases on the average with 15-20 W a year in boys, and with 10-12 W in girls. The relative work capacity does not show considerable changes its increase during the past years being within the limits of 0.1 - 0.3.

The maximum oxygen uptake increases on the average with 0.40 l. for boys per year which is above the mean values (0.25 l.) for untrained children and 0.250 - 0.300 l. for girls which slightly exceeds the normal annual increase. (0.230 l.). Given in percents these values are accordingly 15% for boys and 9-10% for girls. The yearly growth of the relative oxygen uptake in boys is from 1.5 to 5.9 ml., and for girls - from 0.3 to 2.3 ml.

This delay, even the tendency to a slight increase of the relative oxygen uptake is due to the effect of athletic training on the body. It is well-known that with the increase of the weight, this index decreases.

Comparing the dynamic changes in individual indices by groups, the impression is that the boys from the second group have the best physiological indices most probably due to better morphological parameters.

Comparing the aerobic capacity with the performance in the 300 m. run, it is evident that the improved aerobic capacity corresponds to the sports technical results (Table 2) achieved.

year	300 m. running		Yearly growth of the aerobic capacity	
	boys	girls	boys	girls
1972	44.8	55.9 sec.	0.240 l.	0.160 l.
1973	41.8	49.1	0.350	0.260
1974	40.2	47.3	0.500	0.350

Longitudinal studies of the morphological and physiological indices always yield better information than transversal ones. Though the observation period is short, the results obtained give us grounds to draw the following

Conclusions:

1. The lower yearly growth of the height of the groups observed as compared to that of the controls shows that the accelerated children are given priority in the selection.

2. The physiological index which is first influenced by athletic training is the pulse frequency.

3. The maximal oxygen uptake indicates a higher yearly growth as compared to norms for untrained children.

4. The existing parallel between the improved physiological and sports technical indices of the groups under review found a real expression in their classification at the Fourth Republican Field-and-Track Spartakiade for juniors where they won the first place.

Application: Table 3 - Figures obtained from the observed anthropometric, physiological and sports technical indices.

THE IMPORTANCE OF SPIROERGOMETRIC INDICES IN THE SELECTION OF YOUNG ATHLETES

I. Iliev - Bulgaria

Performances in the various sports events have constantly been increasing thanks to improvement of the means and methods of athletic training, as well as to the improved technique. Furthermore, the strive for higher performances led to the necessity of predicting the sports records based on a careful medical-biological, biomechanical and mathematical analysis. Volkov, predicting the world records in different running distances for 1980, has pointed out not only the sports results, which will be probably achieved, but also the most likely physiological characteristics of the record-holders. According to him the record-holders in the middle and long distance runs will have a maximal oxygen uptake of 6 l./min.

Saltin and Astrand, after studying the maximum oxygen uptake in athletes of world rank during the past years, reached the conclusion that in the future, values of 6 l/min. will have to be considered.

On the other hand, Astrand comparing the maximum aerobic capacity of untrained people with that of well trained subjects, came to the conclusion that the genetic factors and inborn abilities are usually more important for the capacity of work than the level of training.

Ekblom studied the same problem. Comparing the data from the relative maximum oxygen uptake in untrained subjects - 30-36 ml./min. with those in outstanding athletes - 80-85 ml./min., the question "How have athletes achieved such high values bearing in mind the fact that by means of training the aerobic capacity can increase by 20-30%. Are the aerobic possibilities influenced by

genetic factors only or can this index be influenced by physical training before and during puberty? As a result of a number of investigations, he came to the conclusion that "physical training before and during puberty seems to increase the cardial output and the maximum oxygen uptake."

From the above said it becomes clear that in selecting athletes for high sports mastership, one should pick up individuals with a high aerobic capacity. We are far from the idea to make absolute the importance of this physiological index because it is obvious that not all persons with a high aerobic capacity can become champions but on the other hand there are no champions with a low aerobic capacity.

Proceeding from these facts, we included the spiroergometry in the compulsory investigations of children applying for the Secondary Sports School in Plovdiv.

MATERIAL AND METHOD

We investigated a total of 120 children - 57 girls and 63 boys. The mean age of the children was 10,10/12.

A maximum ergometric stress was applied by means of the stepwise constant load increase adopted in this country (starting with 60 W at 60 revolutions/min., every 90 sec. the load was increased with 30 W for the boys and 20 W for the girls/. Veloergometer "Medicor" - Hungary and Spirolyt II - German Democratic Republic, were used.

RESULTS AND DISCUSSION

Table 2 shows the results obtained from the investigations in boys and girls divided up into weight groups. It can be seen that at this age also, the children with a smaller weight have lower absolute values, and higher relative values for all spiroergometric

indices. In general, the indices are high because it is a matter of children who more or less have taken part in out-of-school sports activities. Most striking is the great difference between the highest and the lowest values of aerobic capacity - from 1.70 to 2.70 l/min. absolute, and from 39 to 64 ml. min relative for girls, and from 1.80 to 2.70 l/min.,accordingly 46.8 to 71 ml./min. for the boys. It is obvious that the possibilities of the children differ to a great extent, and if we want to attain a better final result we have to include in the training program those of the children who have higher aerobic capacity.

The results of the study were used to work out approximate norms which should be met by the candidates for secondary sports schools.

Including spiroergometry in the compulsory examination of the candidates for sports schools is difficult. It is time consuming (14-15 children can be investigated a day), while the term for the entrance examinations is only a few days. Inspite of that the main difficulty is due to unavailable equipment. In order to carry out such an investigation systematically it is necessary to open laboratories for functional diagnosis in childhood and adolescence at the medical sports dispensaries. Only then the selection of children for inclusion in the high-performance training programs will meet contemporary requirements. Thus acceptance of children who do not justify the hopes will be avoided up to a certain extent.

CONCLUSIONS

1. It is important and necessary to include spiroergometry in the compulsory investigations for athletic selection in childhood and adolescence.

2. During the year, the children applying for the Secondary

sports school in Plovdiv have shown a good aerobic capacity.

3. For the wider use of spiroergometry in the selection of young athletes, it is necessary to equip functional consulting rooms for children and adolescents.

4. Some approximate norms for spiroergometric indices are offered.

INFLUENCE OF THE RALLY ON SOME PHYSIOLOGICAL FUNCTIONS

V.Gavriiski - Bulgaria

The working conditions in rally and motorcycle sport events are specific. The hitting of distance is done by the machine itself and the physical strain of the competitors is limited. It yields to the nervous-psychological stress due to a complex and strennous environment. In rallies the muscular activity of the competitors is minimal, but their exactness and coordination must be perfect. Each reaction of the driver at high speeds must be adequate to the visual signals received.

Investigations on the organism of the driver-competitor are scarce both abroad and in this country. The present work is a modest attempt to fill up this gap. The studies were carried out during the Balkan rally in September 1970. The itenerary of 2,100 km. was of varied nature. It included 6 special trials on hard itinerary, two alpine runs and a competition for skilful driving after the finish. The rally lasted for more than 40 hours interrupted only by short inarvals for equalization of the hour schedule. In its greater part the rally was during the night.

METHODS OF INVESTIGATION

Several teams with Bulgarian participants have been chosen at

random. They were investigated before the start and after the finish. 14 persons were investigated at the start and 9 - at the finish (8 men and 1 woman), aged 23 to 35.

The following indices were measured in all competitors:

1. Critical flicker fusion frequency (CFFF) with Pudritzki apparatus (13), with accuracy of reading - 1 Hz (Hz). Before the measurements were taken to the subjects under study the method of investigation was explained and one or two trial measurements were taken. Then the actual measurements were carried out at least two times, ascendantly and descendantly.

According to a number of authors the CFFF values are influenced by many factors. The most essential are the intensity of the flickering light, light/dark period ratio, and eye adaptation. Therefore for practical reasons, the investigation of CFFF should be carried out under standard conditions.

2. Arterial pulse and arterial blood pressure. The pulse rate was taken for 15 sec., and blood pressure was measured according to Korotkov.

The data obtained were processed statistically calculating the G and t-criteria. As a reliable difference that one was accepted, supported by $Pt > 0.95$.

RESULTS

1. CFFF. Before the start, the flicker fusion of the competitors under study was between 28 to 44 Hz or 38.22 Hz on the average.

Immediately after the finish an increase of CFFF values in all competitors was noticed. In some the increase was almost double: for example from 39 to 75 Hz, from 28 to 50 Hz, from 33 to 63 Hz. The average value after the finish was 59,05 Hz.

2. Arterial pulse. The pulse rate before starting was between 78 and 99 beats per minute (on the average 86 per minute). A mode-

rate tachycardia was present, attributed to the prestart condition. No essential changes were found in measurements after the finish: 78 to 105 per minute or 90 per minute on the average.

3. Arterial blood pressure. The systolic pressure before the start was between 120 and 135 Hg mm. (torrs), or 125 torrs on the average. At the finish the data were 110 to 140, or 123,12 torrs.

4. The diastolic blood pressure before the start was within the limits of 60 to 75 torrs (on the average 71,87 torrs). Immediately after the finish the values were 75 to 100 torrs or 85 torrs on the average. The difference obtained is statistically reliable.

DISCUSSION

The data about CFFF before the start coincide on the whole with with the data obtained by other authors. They are similar to other data obtained by us during the study of workers. The somewhat higher mean values of the CFFF in drivers are probably due to the prestart excitement.

Many authors are in the opinion that CFFF is important as a test indicating fatigue. According to Schmidtke (1949) there is a correlation between the degree of fatigue and the level of decrease in CFFF. Such a proportionality, however, is rejected by Arnold (1953), Jacobi (1957) etc. The opinion that CFFF is more strongly influenced by fatigue as the result of a nervous-psychic stress is more acceptable. Such influence is rejected in a number of cases where fatigue occurs after physical stress (Arnold, 1953; Arnold u. Machholder, 1953; Jacobi, 1957; Pudritzki, 1960).

We too obtained some data related to the problem. When investigating CFFF in the course of a working day, at the beginning of work the mean CFFF was 29.09 Hz, and at the end of the working day - 24.65 Hz (t = 0.97). A decrease in CFFF at the end of the

working day which is statistically reliable is evident. At the same time, no changes were found in the pulse rate of the investigated workers from the electronic production: at the beginning of work - pulse rate for 10 sec. - 13.06, at the end of the working day - 13, 56 for 10 sec. It was logical to admit that as a result of the eight-hour working day fatigue has set in. We were inclined to explain the decreased CFFF by the ensuing fatigue.

The conditions during the rally (constant driving, minimum possibilities for sleeping, high nervous-psychic tension) gave us sufficient reason to expect a fatigue state in competitors at the end of the rally, respectively a decrease in CFFF. This expectation was strengthened by the data reported by Freytag and Böttger (1963) who established a decrease in CFFF at the end of a motorcycle race.

The data obtained by us, however, proved contrary to anticipations. The CFFF values at the finish considerably exceeded the values recorded before the start.

What are the possible causes for this increase?

First of all we must bear in mind the necessity of an optimal excitability in the visual system and the C.N.S. during the rally. This increased excitability has been preserved up to and a little after the finish (the repeated investigations have been done only 2 or 3 minutes after crossing the finish line). It is most probable that the second investigation was made during a stage of increased excitability of the recovery period. The considerable increase in CFFF may be considered as a proof of this fact. The differences between our data and those of Freytag and Böttger might be explained by the phase character of the recovery and by the investigations performed in different phases. (1963).

The final elucidation of the problem requires further investigations on the problem with a continuous CFFF study during the recovery period after competitions.

The increased excitability of the C.N.S. is undoubtedly due to the use of stimulating drinks, such as tea and coffee during the competition. According to Simonson and Enzer, Mücher and Wendt (cited by Müller-Limmroth, 12), central nervous stimulants such as caffeine, account for CFFF enhancement.

The increased diastolic blood pressure is also noteworthy.

It is known that the diastolic pressure reflects mainly the condition of the vascular tone. It is obvious that the driving conditions have influenced the vascular tone. The compulsory, almost static position of the competing driver leads to a static strain of varying duration which is especially characteristic of the lower extremities. A possible expression of an increased vascular tone as result of that is the increased diastolic pressure is a possible manifestation of the increased vascular tone ensuing.

SOME PROBLEMS REGARDING THE PHYSIOLOGY OF THE CENTRAL NERVOUS SYSTEM IN HIGH LEVEL ATHLETES

A. Demeter - Romania

Up-to-date sports-medical usage demands an extension of functional researches into the activity of the central nervous system, including that of the cortex, considered today as a real "control panel" of all vital behaviours within the athlete's body which coordinates, adjusts and adapts to effort all its functions.

As compared to the theoretical and practical importance of the exploration of the different parameters of the central nervous func-

tion, and to the ever increasing technical possibilities which are by hand in this field nowadays, the research in the central nervous system and particularly the real usage of its data haven't been properly applied in sports medicine as yet.

Although the functional exploration of the central nervous system is of a recent date, being almost completely tributary to the advent and development of electronic equipment (which is not the case, to the same extent, of the exploration of the athlete's circulation and breathing), it is now necessary by means of special efforts and a more rapid progress to catch up the development of all the traditional fields of sportive medical research.

Ensuring the functional interdependence of all mechanisms involved in effort, the central nervous system provides the functional unity of the whole body, as well as its adaptation to the continuous changing conditions of the environment, including the special conditions of altitude, clime differences, humidity, temperature etc. Besides that, the nervous system has greatly contributed to the local trophic adaptations and to the continuous changes in the general adjustment as the result of athletic efforts muscular hypertrophy, vagotony at rest and simpathicotony at effort, etc).

As a proof that the central nervous system has a leading role in the adjustement of the whole body to effort and in increasing the functional resources during the training, is the fact that the nervous system itself undergoes important morpho-functional alterations under the influence of the long lasting athletic exertion. According to R.L.friede's data (1966) the vascularization of the cerebral substance increases in the motor zone by augmenting the number of capillaries per mm^2 with 20% as a result of a sustained effort lasting for 3 months, the synaptic nodes interpose in the

way of a long time repeated motor reflex, become larger in surface and closely attached to the post-synaptic membrane and even more numerous.

The motor neurons from the marrow and cortex being continually stressed enlarge their volume with 34%, important biochemical and submicroscopical alterations take place in the stressed neurons like the lowering of Nissl's corpuscles and enlargement of the volume of the neurons' nuclei. (Tumanov, V.P. and Krivitskaia,G.N. 1967).

The functional exploration of the central nervous system aims:

1. the fixing of functional parameters in standard conditions regarding: time of reaction, quick adaptability, speed of formation of some elementary motor habits, coordination capacity, equilibrium, mobility and strength of the fundamental nervous process and so on;

2. the fixing of changes occurring in different conditions of standard effort or specific effort, for different sports events, including isometric exercises which cause an intracranial hyperpressure and hypoxia.

Among the physiological investigation techniques in this study we shall present data and interpretations from the field of electroencephalography, the fixing of critical fusion frequency, intermittent luminous stimulus, the time of reaction, as well as S.N.A. study in athletes.

EEG in athletes

Beside the recordings performed on sick people for establishing the functional cerebral working condition in various pathological conditions the sports medicine and physiology should have knowledge of the cortical biogenesis of athletes, both at rest (in

standard condition) and during the most diverse activities typical for some athletic disciplines.

At rest, in standard conditions, the EEG of the sportsmen is placed among the EEG of the normal grown-ups individuals. Its aspect in athletes is a demonstrative sample of a normal EEG. Except for some cases of latent tetany, sensible hyperventilation, the neurological pathology of the EEG in sports rare except for cases with athletic injuries on which we shall refer later on.

In chart I we give specialized literature on the main EEG categories in untrained people and in toplevel athletes (chart I).

As regards some innermost features of the EEG at rest trajectories in sportsmen, together with A.Gagea and Al.Partheniu after a mathematical computing of about 1000 EEG curves, we came to the conclusion that the optimal alfa index varies from one sportive branch to another, for example: in sharpshooters it is 45-48%.
The above mentioned authors have also noticed that in case of a good cerebral neurodynamical equilibrium the alfa rhythm has an evident fusion organization and the ratio of the anterior/posterior alfa index is 1/6-1/7.

If the standard EEG of sportsmen are rather numerous, the data regarding the EEG aspect in sportsmen exposed to a special training task are rather few and uncertain for interpretation, the EEG waves being mingled with many artifacts. The broadcasting of the EEG from the last 10 years has succeeded to provide valuable data concerning pilots and athletes. The first EEG broadcasting of the pilots during the whole trans-Atlantic flight fulfilled by Blanc, C. and collab. in 1966 opened an era of remarkable technical performances in this field. Only a year later Adey, W.R.and collab. (1967) succeeded to underline the increasing of the theta energy wave of Frank Borman's