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【1A-1】

**Does physically active lifestyle moderate the association of low birthweight
with low cardiorespiratory fitness in children?**

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The purpose of this study was to investigate whether birthweight acts as a biological determinant of later cardiorespiratory fitness (CRF), and whether this association is mediated by physically active lifestyle in children. The subjects included 648 elementary school children aged 6-12 years. Birthweight was reported according to Maternal and Child Health Handbook records. CRF was measured by a 20 metre shuttle run test, and the number of completed laps at volitional exhaustion was used as an indicator of CRF. Information on physical activity (PA) was obtained by a questionnaire filled by parents, which asks weekly time spent

on habitual exercise activity (min/week). Current body mass index (BMI) was calculated from measured height and weight. Lower birthweight was associated with lower CRF ($\beta = 0.07$, $p < 0.05$), after adjustment for sex, months of age, school year, and current height and BMI. This association was little changed by PA ($\beta = 0.07$, $p < 0.05$), however, PA was a stronger predictor of CRF than birthweight ($\beta = 0.12$, $p < 0.001$). This study suggests that birthweight acts as a biological determinant of CRF in childhood, however, physically active lifestyle may substantially improve CRF irrespective of an individual's low birthweight.

【1A-2】

Age-related differences in the Achilles tendon moment arms scaled by selected body dimensions: A cross-sectional study

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The purpose of this study was to compare the Achilles tendon moment arm among different age groups. Sixteen boys aged 7-9, 16 boys aged 10-12, 21 boys aged 13-15 and 19 adult males voluntarily participated in this study. A series of coronal magnetic resonance images of right ankle were obtained and the Achilles tendon moment arm was calculated as the shortest distance between the talocrural joint axis to the line of action of the Achilles tendon force projected to the plane orthogonal to the talocrural joint axis. The Achilles tendon moment arm was scaled by the body mass and the moment arm of the ground reaction force estimated from the lower leg length and the foot length by using the equation proposed by Trinkaus and Rhoads (1999). Body mass is one of the major determinant of the ground reaction force. The Achilles tendon moment arm scaled

by the moment arm of the ground reaction force reflects the mechanical advantage, because the ratio of the moment arm of the ground reaction force relative to the Achilles tendon moment arm defines the mechanical advantage. The mean value of the Achilles tendon moment arm scaled by body mass in 7-9 years was significantly greater than those in the other age groups. There are no significant differences in the Achilles tendon moment arm scaled by the moment arm of the ground reaction force length among different age groups. Boys aged 10-15 has the similar foot structure as the mechanical advantage and smaller foot structure relative to the body mass as compared with boys aged 7-9. This may explain one additional reason for the higher incidence of the calcaneal apophysitis in 10-14 years boys.

【1A-3】

**Effects of exercise intensity and antioxidant supplementation
on exercise-induced mitochondrial biogenesis in mice skeletal muscle**

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It has been known that reactive oxygen species (ROS) is one of the regulators of mitochondrial biogenesis. However, the effects of antioxidant supplementation on exercise-induced skeletal muscle adaptation have not been determined yet because of the differences in the study design. It has been reported that the cellular signaling pathways are not activated to the same level even if mitochondrial enzyme activity are increased to the same level by different intensities of exercise. Hence, it seems that the magnitudes of the effects of ROS and/or other signal pathways on mitochondrial biogenesis are differ with the exercise intensity. The purpose of this study is to determine the effects of exercise intensity and antioxidant supplementation

on exercise-induced elevation in markers of mitochondrial biogenesis in mice skeletal muscle. C57BL mice will be allocated into 8 groups according to the exercise intensity and antioxidant supplementation. The mice of antioxidant group will be administrated vitamin C and vitamin E for two weeks. The mice of the exercise group will be subjected to low-, middle- and high-intensities of treadmill running. After the exercise, muscle will be dissected for the measurement of markers of mitochondrial biogenesis and oxidative stress. At present, we are investigating the exercise intensity and duration of the high-intensity exercise for the induction of mitochondrial biogenesis and the related parameters.

【1A-4】

Effect of low-level laser irradiation on muscle hardness and tension

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Low-level laser irradiation (LLLI) has been reported to retard muscle fatigue. Here, we examine whether 3 different wavelength of LLLIs are able to retard muscle fatigue in the rat gastrocnemius muscle in vivo. Three types of laser generators (405 nm, 532 nm and 808 nm: 100 mW) were used. Tetanic stimulation with a supramaximal intensity (10 V) and a frequency of 50 Hz was delivered to the tibial nerve for 2 s. Animals in the control group received 10 sets of tetanus with an interval of 2 s, followed by a brief resting period for 15 s, and 1 further set of tetanus. Animals in the experimental group received the same protocol with LLLI for 15 s instead of the resting. Muscle hardness and

tension were measured by a hardness meter and tension transducer, respectively, before and after the initial 10 sets of tetanus, after resting/LLLI, and following final tetanus. Data was standardized according to the initial values measured after the 10 sets of tetanus and set as 100%. Muscle treated with the 808 nm LLLI showed a significant improvement in the recovery of muscle hardness ($p < 0.05$ vs. control). Treatment with the 532nm LLLI significantly improved muscle tension ($p < 0.05$ vs. control). Since particular LLLI wavelengths improved specific muscular characteristics, we concluded that LLLI has potential for treating muscle hardness or tension.

【1A-5】

cDNA microarray analysis identifies new target genes altered by hindlimb suspension and electroacupuncture

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Acupuncture treatment is a branch of East Asian traditional medicine and the practical value of this therapy is already established; however, the molecular mechanism is not completely understood. As a continuation of our previous hindlimb suspension (HS) study, we investigate the expression of new target genes by cDNA microarray analysis. We found that a set of 52 target genes were up regulated by hindlimb suspension and down-regulated by electroacupuncture (EA). We also found a separate set of 53 target genes that were down regulated by HS and up-regulated by EA. Ccl21

is a known secondary lymphoid tissue chemokine, and it was significantly down regulated by HS and up-regulated by EA ($p < 0.05$, $n = 7$, respectively). Matrix metalloproteinases (MMPs), especially MMP-13, were the most up regulated gene group by HS ($p < 0.05$, $n = 7$). These genes are thought to play a major role in cell behaviors such as cell proliferation, migration, and apoptosis. These results indicate that several genes, such as Ccl21 and MMPs, are novel target genes of both HS and EA treatment; these treatments result in their altered expression pattern.

【1A-6】

The accuracy of services of various sports

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In this study, we investigated the accuracy in services of various sports with special attention to the error and fluctuation of the point where services hit the floor around target. The subjects who participated in the experiment were consisted of 8 volleyball players, 6 badminton players, 7 tennis players, 8 soft tennis players and 9 table tennis players. The players performed services aiming at a target in three conditions. (1) Side; the target was at 1/6 from the edge of the service area at the easiest speed. (2) Center; the target was at the center of the service areas at the easiest speed. (3) Game; the target was the same as the Side with the similar to

first service in real game. The accuracy in the services was evaluated by the mean and SD of distances between the target and the points where served balls hit the floor. In addition, normalized error and standard deviation(SD) (%) was obtained by dividing the distances with the length between the target and the service position. The result showed that there existed normalized SD of about 3%. Also, there was variability in the distribution pattern of services unique to each sports. SD of about 3% might be inevitable in human actions of projecting balls with a racket/hand.

【1A-7】

The effect of hip joint angle on concentric knee extension torque

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The purpose of this study was to examine the effect of hip joint angle on the maximal voluntary concentric knee extension torque. We hypothesized that the concentric knee extension torque as a function of knee joint angle is different between extended and flexed hip positions. Twelve healthy men performed concentric knee extensions at fully extended (0°) and flexed (80°) hip positions with the maximal effort. The angular velocities were set at 30°/s and 180°/s with an isokinetic dynamometer. The range of motion of the knee joint was from 110° to 20° (full extension = 0°), and the knee extension torques attained at 30°, 50°, and 70° were compared between the two hip positions. Surface

electromyographic (EMG) signals were recorded from the vastus lateralis, vastus medialis, rectus femoris, and biceps femoris. In both angular velocities, the knee extension torque at 70° was higher in the flexed hip position than that in the extended hip position. On the other hand, the knee extension torque at 30° and 50° was similar between the two hip positions. There was no main effect of the hip joint angle in the EMG amplitudes of any muscles in each velocity contraction. These results supported our hypothesis and might be related to the force-length and force-velocity characteristics of the rectus femoris.

【1A-8】

Knee joint position sense after anterior cruciate ligament reconstruction

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The purpose of this study was to assess the sensorimotor system at knee joint and observe the behavioral characteristics of subjects that can be caused by anterior cruciate ligament reconstruction (ACL-R). We examined 7 subjects with ACL-R (2 men and 5 women) and 10 healthy age matched volunteers (4 men and 6 women) with no history of previous knee injury. In this study, all blindfolded subjects were instructed to perform two tasks in sitting position; joint position sense (assessed by the reproduction of passive positioning and active repositioning of the knee) and position matching at the knee. The target angle was set at 30 degrees

(=knee flexed at 60 degrees) toward knee extension as the starting position (=knee flexed at 90 degrees) was defined 0 degree. As for joint position sense, there were no significant differences between legs and conditions (active or passive) in both groups ($p>0.05$). However, in active matching, matching errors differed depending on the reference leg in the ACL-R group: reconstructed or non-reconstructed ($p<0.05$). Although this is a preliminary study, our result currently demonstrates that the ACL reconstruction has an influence on the knee joint position sense in active matching.

【1A-9】

Variability of resting energy expenditure in male collegiate athletes is influenced by fat-free mass and triiodothyronine but not individual organ mass

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The purpose of this study was to examine whether it is necessary to consider organ mass for better accuracy to estimate resting energy expenditure (REE) of male collegiate athletes. Subjects were thirty-six college male American football players. REE was measured (REEm) by indirect calorimetry and body composition was measure by DXA. Mass of brain, liver, and kidney were obtained by MRI and mass of heart was estimated using echocardiography. Multiple regression analysis was used to assess the influence of each organ mass on REE by changing organ in addition to FFM and Triiodothyronine (T3) for each analysis. Average body weight and FFM were 82.4

± 11.1 kg and 68.9 ± 7.4 kg, respectively. Average REEm was 1858 ± 221 kcal and metabolic rate of FFM was 27.6 ± 2.0kcal/kg/day. According to the multiple regression analysis, FFM alone explained 68% of REE ($R^2=0.68$, $P<0.001$). T3 was also independently influence the variability of REE, and explained additional 8% of REE ($R^2=0.76$, $P<0.001$). When FFM and T3 were adjusted, none of the organ influenced independently as the variable of REE. Based on these result, it is suggested that when FFM and T3 are used to estimate REE, considering organ mass does not increase the accuracy of estimating REE for male collegiate athletes.

【1B-1】

**Effects of motor skill training on lower extremity kinematics
in young female basketball players: a research proposal**

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Many investigators have developed anterior cruciate ligament (ACL) injury prevention programs and evaluated their effectiveness. In spite of these initiatives, epidemiological data show that the rate of ACL injury is not declining. One problem is the fact that the transition from conscious, deliberate movements during training sessions to the unexpected and automatic movements during a practice or game might not be successful. From a motor skill development standpoint, it is desirable to implement a program in young athletes to develop proper movement patterns from the beginning. The purpose of this study is to evaluate whether motor skill training improves

lower extremity kinematics and reduces the risk of developing ACL injury in young female basketball players. Eighty female subjects from 4 junior high school basketball teams will be recruited and placed into training or control groups. The training group will have a 12-week long motor skill training. ACL injury risk will be evaluated using the ACL injury prediction algorithm at pretest, post-test, and 3 months after cessation of training. For those athletes determined to be at high risk, knee kinematics during a practice session and a game will be assessed using the model-based image-matching method.

【1B-2】

Development of a method to identify the entire range of 3D shoulder motion

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The present study was aimed to develop a method for measuring the entire range of shoulder motion. Two subjects participated in this study. Prior to the measurement, the ranges of the maximum humeral abduction/adduction and the maximum horizontal adduction/abduction were recorded previously. These data were used to divide the globographic representation of shoulder range of motion into four quadrants; upper-front, lower-front, upper-back, and lower-back quadrants. To identify the entire range of shoulder motion, the subjects were instructed to perform five sequences of shoulder movements with the dominant arm maintained in the maximally internally rotated position. A sequence was performed in each quadrant; only in the case of lower-front quadrant, two sequences were performed to cover the large region. An electromagnetic goniometer system was used to measure horizontal abduction, elevation and internal rotation angles throughout the movements. The

determined series of internal rotation angles were expressed as a function of the horizontal abduction and elevation angles to define the boundary of maximum internal rotation angles for given combinations of horizontal abduction and elevation angles. The same procedure was repeated for maximum external rotation, so that the determined two boundaries could “envelope” the entire range of shoulder motion permissible to the given shoulder. The day-to-day reliability of the boundaries was found high (ICC > 0.952 for internal & 0.957 for external rotations). The ranges of shoulder motion were determined with the standard clinical procedure and used as the reference to test the validity of the procedure. The percent errors were less than 7.5 %. It is concluded that the present procedure offer an accurate and convenient approach for measuring the entire range of shoulder motion that is available for clinical use.

【1B-4】

Effect of head up motion on arm coordination in the front crawl.

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The purpose of this study was to determine the effect of head up motion on arm coordination in the front crawl. Thirteen surf lifesavers performed both front crawl (FC) and head up crawl (HU). Stroke rate (SR), stroke length (SL), duration of stroke phase, and index of arm coordination (IdC) were measured on left and right arms respectively. On HU, asymmetric arm coordination in left and right arms was observed. IdC on one side was catch-up while on the other side was superposition. This change resulted in a reorganization of arm phases: Right arm of HU showed significantly longer stretch phase, while shorter pull and recovery

phases than one of FC ($p < 0.05$). Left arm of HU showed significantly shorter stretch phase and longer push and recovery phases than one of FC ($p < 0.05$). On HU, right arm had significantly longer stretch phases, while shorter than left arm ($p < 0.05$). These changes were coupled to increase in SR and decrease in SL. These findings indicate that lifesavers would spend longer stretch phase to check buoys on one side. On the other side, they spend longer propulsive phase to go forward. This could result in their asymmetric arm coordination in HU.

【1B-5】

**The Angular velocity of torso segments and the bat in baseball batting :
a pilot study**

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The purpose of this study was to describe the magnitude and the orientation of the angular velocities of the pelvis, the thorax and the bat in baseball batting. A left-hand hitter performed 5 trials of “free-batting.” An electromagnetic tracking device was used to record three-dimensional kinematic data of pelvis, thorax and bat for the duration from the instant of touch-down of the step-leg to the ball impact. Angular velocity of each segment was determined for each trial and the mean values across all trials were used for statistical analysis. The maximum angular velocities of pelvis, thorax and bat were found to be 561degree/s,

804degree/s and 2374 degree/s, respectively. The maximum angular velocities were attained in order of the pelvis (94ms before impact (BI)), the thorax (51ms BI), the bat (4ms BI). The angular velocity vectors of the thorax and the pelvis were not aligned, but tilted by 62 ± 30 degrees during the first half of swing and by 19 ± 11 degrees during the second half. These results indicate (a) that the pelvis and the thorax do not rotate as a unit, but moved in a sequential manner and (b) that the torso segments do not rotate around a single axis, but each segment rotates around substantially different axis.

【1B-6】

**Combined three-dimensional torso movement during front crawl swimming
-A preliminary report-**

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Low back pain is a common problem among competitive swimmers and hyperextension of the torso is claimed to be an etiological factor. Our previous study showed that no subject exceeded the active flex-extension range of torso motion in front crawl, however, torso underwent a large complex three-dimensional movement within a very short time. Based on this finding, we suggested that repeated three-dimensional torso motions, rather than single planar hyperextension, might be a risk factor for low back pain among swimmers. The purpose of this study was to test a hypothesis that swimmers exceed the torso active range of motion during front-crawl swimming. Two college students participated in the pilot study. Each subject

participated in two data collection sessions: An active range of motion measurement and a front crawl trial. A simplified kinematic model composed of thorax and pelvis was used to describe the torso configuration and an electromagnetic tracking device was used to record the movements of the two segments. Subjects were asked to extend torso in several twist planes with their maximum lateral tilt for determining the active torso range of motion which indicated the motion permitted to their anatomical structure. The torso motion exhibited during front crawl trial was compared with the active range of motion. The results showed that no subject exceeded the active torso range of motion permitted to the structure during front crawl.

【1B-7】

A comparison of visual analog scale and Likert scale in anticipation task

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In previous studies, visual analog scale (VAS) had the advantage compared to the Likert scale (LS). However, the VAS has not been used in perception research. The present study compares VAS and three point LS. The aim of this study is to determine whether VAS can be used as an alternative tool to LS when evaluating reaction in anticipation research. Twenty four males (twelve expert players and twelve novices) voluntarily participated in the experiment. The participants viewed forty five video clips of themselves under the following three occluding conditions: to the back-scratch position (T1), to one frame prior to the racket-ball contact

(T2) and to the point after the racket-ball contact (T3) from the ready position. The participants scored their anticipatory judgment of the ball direction on a pen-paper method (VAS and LS), respectively for each clips. The result showed a high correlation between the VAS and the LS in all occlusion conditions. Thus, the VAS can be used as a perception tool. Moreover, the VAS appears to be a reliable and valid alternative to the LS for reaction method of anticipation experiment. The VAS was shown to be an effective tool for anticipation research.

【1B-8】

**Two mechanisms for the “opposite field hitting” in baseball:
Unexpected findings from an experimental study**

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The “opposite-field hitting” is enabled by hitting the ball with the bat angled horizontally and facing its impacting surface toward the opposite field (the first mechanism). The batters intending to hit toward the opposite field consciously adjust the magnitude of the horizontal angle at impact so as to project the batted ball toward the intended direction. Theoretically, the batters can adopt other approach to successfully hit the ball toward the opposite field: Assuming that the batter hits the lower part of the ball with a bat positioned horizontally and facing toward the center field, the batted ball should travel upward toward the center field. If, however, the bat

facing toward the center field is tilted downward to position the head slightly lower than the grip, the batted ball should travel upward and toward the opposite field. This example provide us with the second mechanism that the interaction of the vertical tilt angle of the bat and the undercut distance of the ball enables the opposite field hitting. The present study was conducted to determine the contributions of these mechanisms in opposite-field hitting. The 146 trials were analyzed and found that the contribution of the second mechanism (76%) was greater than the first (24%).

【1B-9】

**The influence of breathing techniques on passive drag force of swimming. :
A preliminary report**

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The purpose of this pilot study was to examine if the passive drag is altered due to the difference in trunk shape formulated by adopting two breathing techniques; chest breathing and abdominal breathing. Two competitive swimmers participated in this pilot study. Subjects were asked to float on the water surface by inhaling 60% of the maximal inhalation volume with both breathing techniques, and were towed at five different towing forces. The drag coefficients (C_d) were calculated with the least-square method for each breathing techniques. During the measurement, a periscope system was used to record the sagittal plane images. The results

showed that the drag coefficients of one subject was smaller with abdominal breathing ($C_d=0.37$) than chest breathing ($C_d=0.39$). On the other hand, the drag coefficient of the other subject was larger with abdominal breathing ($C_d=0.43$) than chest breathing ($C_d=0.40$). Both subjects had a tendency of changing their posture, especially their extension angle of the lumbar region, creating different waves between breathing techniques. The difference in the C_d values recorded from the subjects may be resulted the difference in the form drag and wave drag between breathing techniques. The posture need to be controlled for future studies.

【1B-10】

Dynamics of Bat-swing in Baseball Batting

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The purpose of this study was to describe dynamics of the bat-swing in baseball batting. Seventeen male collegiate baseball players were asked to perform tee-batting. A motion capture system operating at 500 Hz was used to determine 3-D coordinates of markers attached onto the bat, ball and selected body landmarks. The resultant force and resultant moment exerted on the bat by the hands were calculated with the inverse dynamics procedure. In this study, these parameters were represented in a bat-embedded orthogonal coordinate system which was defined as the y -axis pointing in the direction of the velocity of the center of gravity of the bat, the z -axis pointing in the direction of the angular velocity vector of the bat,

and the x -axis (centripetal direction) being the cross-product of the z -axis and the y -axis. The x -component of the resultant force increased in the positive direction from 0.2s before ball impact (BI) and attained about 700N at BI and acted on nearly the longitudinal axis of the bat. At the same time, the z -component of the resultant moment increased in the positive direction until 0.06s before BI and attained about 13Nm, then this moment decreased just before BI. The magnitude of y -component of the resultant force was less than 30% compared to that of x -component. These results suggest that the batters moved the bat in a curved trajectory by the large centripetal force, and accelerated that by the slight resultant moment.

【1B-11】

**Difference in the whole body rotation mechanism during sidestep cutting
between skilled and unskilled athletes: A preliminary report**

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The purpose of this study was to compare the rotational aspect of whole body motion during sidestep cutting between the skilled and unskilled athletes. One basketball (skilled) and one track & field (unskilled) athletes performed 30° sidestep cutting at the speed of 5 ± 0.5 m/s. The subjects were instructed to run straight before changing the direction sharply in one step. A motion capture system was used to record the whole body motion. The angular momentum of whole body about the center of mass (H) in flight phase immediately before and after the cut was determined by the method described by Dapena (1978), and separated into 5 components (Head & Trunk, right and left

arms, and right and left legs). $H_{\text{Head\&Trunk}}$ of unskilled subject was directed to tilting inward of running path before and after the cut. On the other hand, $H_{\text{Head\&Trunk}}$ of skilled subject was directed to tilting outward before the cut, and to tilting inward after the cut. These results indicate that the skilled subject performed the counter movement to change the movement direction sharply before the cut. The present study demonstrated that the difference in the whole body rotation mechanism during sidestep cutting between the two athletes was the preparatory motion of head and trunk tilting outward or inward.

【1B-12】

**Trajectory of an effective baseball pitch based on bat trajectory
for hitting a ball at different location**

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Baseball batters are required to hit a thrown baseball at the right location and right time. The chance for a swung bat to make a contact with the ball will increase if the bat trajectory and ball trajectory are matched longer. In this study, nine collegiate baseball field players were recruited to perform hitting a baseball off a tee at five different ball location (high, low, outside, middle, and inside) for six times in each location. Three dimensional analysis of swung bat trajectory and ball-bat contact were performed by digitizing the swung bat and ball captured by two synchronized video camera (Frame rate of 1000 frames per second). There was a

significant difference in vertical angle of bat swing when subjects hit a ball in high location vs. low location ($8.6 \pm 3.8^\circ$ vs. $2.2 \pm 7.4^\circ$, respectively). In addition, there was a significant difference in lateral angle of bat swing when they hit a ball in inside location vs. outside location ($27.0 \pm 5.8^\circ$ vs. $-5.8 \pm 7.4^\circ$). Based on the results, it was suggested 1) sinking type pitches (such as forkball and change-up) are harder to hit when they are thrown at low location, and 2) laterally moving away pitch (such as slider and cut-ball) are harder to hit when they are thrown in outside location.

【1B-13】

Establishing a new method for measuring the Achilles tendon length

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To date, there has been no method to directly measure the whole Achilles tendon length during dynamic movements such as jumping or running. The purpose of this study was to examine the validity and repeatability of a new method for measuring the Achilles tendon length. Ten subjects participated in this study. Markers were attached on the skin over the longitudinal path of the Achilles tendon. The Achilles tendon length was measured as the sum of distances between the adjacent markers and between the most proximal marker and the distal end of the medial gastrocnemius (located from ultrasonogram), measured at three ankle joint angles (20° dorsiflexion, anatomical position, 20° plantar flexion). Achilles tendon length measured by the above new method was compared to that

measured with magnetic resonance imaging (MRI) to examine the validity. Furthermore, day-to-day repeatability of the new method was investigated. As a result, although the Achilles tendon length measured by the new method (183.0 ± 24.6 mm) was significantly shorter ($p = 0.009$) than that measured with MRI (185.3 ± 24.5 mm), the root mean square error was not large (4.1 mm) and the coefficient of correlation was 0.98 ($p < 0.001$) between two methods. Furthermore, day-to-day repeatability of the new method was high (coefficient of variation: $1.9 \pm 1.3\%$ and intraclass correlation coefficient: 0.97). These results indicate that the new method is useful for measuring the Achilles tendon length.

【2A-1】

Effect of movement complexity and duration on the lateralized readiness potential

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The purpose of this study was to reveal the organization mechanism of motor programming, manipulating two motor-related factors in a random design. Twelve college students (eight female; mean age: 25.7±2.8yrs) participated in this study. Participants were asked to perform choice reaction time tasks, in which they responded to the randomly presented imperative stimulus by pressing buttons with their left or right fingers, respectively, in different response complexity (index→index→index vs. index→ring→middle fingers) and movement duration (short→short→short vs. short→short→long tapping). Only trend of complexity effect ($F(1,11)=7.63, p=.02$) was found on reaction time

which showed faster responses in the complex conditions. Neither significant difference of complexity nor duration effects was observed on stimulus-locked lateralized readiness potential (LRP). Response-locked LRP waveforms showed varied onset timing among conditions, however, such discrepancy failed to reach any significance. The results suggested that two separate stages associated with response complexity and movement duration seemed to exist according to Additive Factor Method logic, which is consistent with our previous finding in a block-wise design. Further research is needed to clarify the functional loci of response complexity and movement duration effects in the random design.

【2A-2】

**The effects of 12 weeks of low-volume walking program
on structural brain changes in elderly adults**

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We examined whether a 12 weeks of low-volume walking program could change the brain volume in elderly adults. Twenty-one elderly adults were assigned to either a walking group (N = 9, 66.2 ± 4.5 years) or a control group (N = 12, 65.5 ± 2.5 years). The walking group walked 30 – 60 min/session on 2 days per week for 12 weeks. The control group was instructed not to change their lifestyle during the study. We assessed cognitive performance using the flanker task and Sternberg memory task, and collected magnetic resonance images before and after study. The walking group showed shorter reaction times than the control

group in both tasks. We found that left cerebellum volume increased in the walking group, but not in the control group, after 12 weeks compared with the baseline ($p = 0.006$). These findings suggest that brain volume in elderly adults can increase even after the 12-weeks walking. Previous studies have reported that the ability of balance control and coordination was positively correlated with cerebellum volume, and cerebellum played a role in the operation of cognitive functions. Therefore, our results suggest that participation in walking program is beneficial not only to improve cognitive function, but also to prevent falls.

【2A-3】

Relationship between rower's low back pain and abdominal muscle

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The purpose of this study was to clear up the types of musculoskeletal problems in collegiate rowers and to investigate relation to low back pain and the form of abdominal muscles. Injury data were obtained from 40 collegiate rowers in two seasons. Twenty-two Subjects of 40 were scanned T1-weighted axial magnetic resonance imaging to evaluate cross sectional area of abdominal muscles. Axial scans obtained at the level of the L4-5 disc interspace. Muscles assessed were the rectus abdominis, oblique muscle group (external oblique, internal oblique, transverse abdominis), psoa s major, elector spine muscle group and quadratus

lumborum. Relationships between cross sectional area of the muscles and low back pain were analyzed using t-test. As the result of injury data, 13 subjects (32.5%) of 40 developed low back pain (LBP) which was defined as pain that make rest training at least 1 day. The means of cross sectional area of left oblique muscle group were 144.3mm² in LBP group and 165.0mm² in the non- LBP group and there were significantly different ($p < 0.05$) between two groups. These findings suggest that LBP is a significant problem in rowers and it may arise as a result of oblique muscle group weakness.

【2A-4】

**Muscle relaxation of the foot reduces the corticospinal excitability
of the hand muscles on both side**

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“Muscle relaxation” is an important factor to make good performances in sports, but its brain mechanism has not been well understood. Transcranial magnetic stimulation (TMS) study suggested that cortical inhibitory system is involved in muscle relaxation (Buccolieri et al., 2004). Furthermore, we demonstrated muscle relaxation of the dorsiflexor muscle reduces the corticospinal excitability of the ipsilateral hand muscles. The purpose of present study is to clarify the time-course of inhibition on ipsilateral (Ex.1) and contralateral (Ex.2) hand muscles by relaxation of right dorsiflexor. Six subjects performed eccentric

relaxation of the right dorsiflexor immediately after an audio cue. TMS was applied to the motor area for the right hand (Ex.1) and left hand (Ex.2) at different timings before and after the onset of the relaxation. Motor evoked potentials (MEP) were recorded from the hand muscles. In the time periods of 0ms to 400ms after the onset of relaxation, the MEP amplitudes of the hand muscles decreased in both side than that in the resting condition. In conclusion, there were reductions of corticospinal excitability of the hand muscles on both sides after 0ms to 400ms from the relaxation of foot muscles.

【2A-5】

Control strategy of two-limb coordinated movements varies with limb combination

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Cyclic two-limb coordinated movements in the saggital plane are more difficult when it is in the opposite direction. Furthermore, the difficulty depends on the combination of limbs. The exact reason why such differences appear has not been clarified yet. In the present study, we investigated the effects of passively-moving one limb on the coordinated movements. Subjects performed the cyclic two-limb coordinated movement in three kinds of combination (ipsilateral hand and foot, contralateral hand and foot, bilateral hands). Each combination consisted of two conditions. First, subjects actively moved two limbs. Second, one limbs was passively moved by an experimenter, and subjects actively moved the other limb in coordination with the passively-moved limb. In the first condition, the difficulty depended on the combination just as reported in previous studies.

However, in the second conditions, coordinated movements of three combinations were equally difficult. Subjects should probably monitor the sensory information from both actively-moved and passively-moved limbs in any combination to make feedback control for the coordination. In the first condition, easy combination to perform would not depend on feedback control so much, and programmed (open-loop) control may be largely utilized. It might be that we had programs of moving both hands or contralateral hand and foot in the opposite direction e.g. for locomotion, so that the movement could be done without feedback control, while there is no innate program of moving ipsilateral hand and foot in the opposite direction and the movement should depend on feedback signals, which makes the control difficult.

【2A-6】

The analysis of movements in aerobic gymnastics to propose drills for beginners

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Aerobic Gymnastics is composed of aerobic steps together with arm movements and each movement requires correct posture and body alignment. The purpose of this study is to analyze how the basic movements of Aerobic Gymnastics differ between subjects with and without experiences in other sports. Two group beginners of Aerobic Gymnastics participated in this study. Group I is composed of ten male beginners who had not any special experience in any sport and group II is composed of ten male beginners who had been trained over 8 years participated in this study. Two tasks were used in experiment, there were without instruction and with instruction. In each task, the subjects were asked to perform those three movements in random order. Three-dimensional marker positions were

recorded with a motion analysis system to capture the movements of high leg kick, tuck jump and turn. Kinematic variables were analyzed for the change of the postural control. The group I demonstrated significantly change in CoP trajectory with direction of anterior-posterior, while group II demonstrated significantly change with direction of medial-lateral. There were no significant differences between two groups under condition of with instruction in two directions and under condition of without instruction in the medial-lateral direction. The current results suggest that beginners should be categorized by their sport experiences in experiment which aims at analyzing the difference between expert and novice.

【2B-1】

Exome sequencing of senescence-accelerated mice

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Senescence-accelerated mice (SAM) are a series of mouse strains consisting senescence-prone (SAMP) and resistant (SAMR) strains. Although SAMP strains have been used for aging research focusing on short lifespan and various age-related phenotypes, such as sarcopenia, osteoporosis, and brain atrophy, the responsible gene mutations have not been fully elucidated. To identify mutations specific to SAMP strains, we performed exome sequencing of 6 SAMP and 3 SAMR strains. This survey revealed 32,019-38,925 single nucleotide variants in the coding regions of each SAM strain. Among them, we extracted 31 SAMP-specific novel mutations predicted to be deleterious. Among the 6

SAMP strains, we detected no novel mutations that were common to all of them. In all SAMP strains except SAMP8, we detected an R473W missense mutation of *Ldb3* gene, which has been associated with myofibrillar myopathy. In 3 SAMP strains (SAMP3, SAMP10, and SAMP11), we identified an R167C missense mutation of *Prx* gene, which mutations have been linked to hereditary motor and sensory neuropathy. Our data indicate that causative mutations for common senescence-prone phenotype of SAMP strains may not exist in the coding regions and different combinations of mutations in disease-associated genes may be responsible for the various age-related phenotypes of SAMP strains.

【2B-2】

**Establishment of cell culture system for analysis
of exercise-induced immunoregulation**

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Obesity is not only a pathological base of the metabolic syndrome, but also is associated with type 2 diabetes, fatty liver, atherosclerosis and cancer. Indeed, obesity is associated with chronic low-grade inflammation, which is characterized by higher expression of pro-inflammatory cytokines in adipose tissue and systemic circulation with the development of obesity. On the other hand, exercise training suppresses inflammation in adipose tissue of obese mice. Reduction in visceral fat mass, increased anti-inflammatory cytokines production and down-regulation of Toll-like receptors are three major possible mechanisms of anti-inflammatory effects of exercise. It had been found that several bioactive substances such as hormones and cytokines are induced during exercise. Notably, glucocorticoid inhibits the synthesis of

pro-inflammatory cytokines, and induces anti-inflammatory cytokines expression. Macrophages play an important role in chronic inflammation of obesity. It is unknown that the anti-inflammatory effects of exercise on obesity are through glucocorticoid-induced anti-inflammatory cytokine production by macrophages. In this study, lipopolysaccharide (LPS) stimulates the inflammation of macrophage's cell line RAW cells, and induces glucocorticoid pathway of RAW cells by treating dexamethasone. We investigate time course and dose-dependence of pro-inflammatory cytokines production (IL-6 and TNF- α) and anti-inflammatory cytokines production (IL-4 and IL-10) by ELISA for establishing cell culture model.

【2B-3】

Effect of Intermittent Physical Activity on Fat Utilization for a Whole Day.

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Purpose: We examined whether continuous and intermittent physical activity (PA) differently influences fat utilization. **Methods:** This was a randomized, cross-over designed study. Nine young male participants performed two PA sessions (i.e. continuous and intermittent exercise) in a respiratory chamber. Participants performed stationary cycling ergometer for 40 and 45 minutes continuously in the continuous PA trial, and for 5 minutes \times 17 times every 30 minutes in the intermittent PA trial. **Results:** 23-h respiratory exchange ratio (RER) adjusted for sleeping RER preceding day in the intermittent PA trial was

significantly lower than in the continuous PA trial ($P = 0.021$). 23-h RER adjusted for sleeping RER on the preceding day was correlated with accumulated consecutive minutes of metabolic equivalents (METs) ≤ 1.5 (3 minutes or more; $r = 0.477$, 5 minutes or more; $r = 0.510$, 10 minutes or more; $r = 0.605$). **Conclusions:** The intermittent PA trial induced greater fat utilization than the continuous PA trial. Since consecutive time of sedentary behavior was associated with lower fat utilization, the present study suggests that we need to keep intervals of each sedentary behavior as short as possible for efficient utilization of ingested fat.

【2B-4】

Effects of physical activity and antioxidant supplementation on oxidative stress in older adults: focus on the amount of physical activity and dose of antioxidant

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The overall purpose of our research was to clarify the relationship between the amount of physical activity and oxidative stress in older adults. Here we report three main findings from our ongoing studies. First, we examined the relationships between the amount of daily physical activity and oxidative stress markers in older adults (Study 1). The main findings were that serum reactive oxygen metabolite (d-ROMs) concentrations were negatively correlated with the amount of physical activity, and that serum biological antioxidant potential (BAP) was positively correlated with the amount of physical activity. Second, we have investigated the effects of a 12-week exercise program below the current recommended amount of exercise (<150

min/week) on oxidative stress and antioxidant capacity in older adults (Study 2). The main findings of this study were that low-volume exercise training (100 minutes of walking a week) attenuates serum d-ROMs concentrations, and increases serum BAP. Third, we investigated the effects of a 12-week walking program and vitamin E supplementation on oxidative stress markers in older adults (Study 3). The results of this study suggest that a 12-week walking program and vitamin E supplementation improve the resting oxidative stress status. The main findings of three researches suggest that physical activity and vitamin E supplementation reduce risks of several diseases related to oxidative stress in older adults.

【2B-5】

**After-school combined exercise programme increases endothelial progenitor cells
in overweight and obese children**

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The purpose of this study was to investigate the effects of an after-school exercise programme on endothelial progenitor cells in overweight and obese children. Total of 29 overweight/obese children were randomly divided into the control (i.e., no after-school exercise, n = 14) or after-school exercise (n = 15) groups. The 12-week after-school exercise intervention consisted of 3 days of combined aerobic and resistance exercise per week. Each 80-minute exercise programme included 10 minutes of warm-up and 10 minutes of cool-down after school. CD34⁺ (a cell surface marker on hematopoietic stem cells), CD133⁺ (a cell surface marker on hematopoietic progenitor cells) and CD34⁺/CD133⁺ (considered as endothelial

progenitor cells) were measured at baseline and after 12 weeks in both groups using flow cytometry. Increased percentages of CD34⁺, CD133⁺ and CD34⁺/CD133⁺ were observed in the after-school exercise group (p = 0.018; p = 0.001; p = 0.002, respectively) compared with the control group. Carotid intima-media thickness decreased after 12 weeks in the after-school exercise group (p = 0.020) compared with the control group. This study provides preliminary evidence that an after-school exercise programme may represent an effective intervention strategy for improving vascular repair and endothelial function, leading to improved cardiovascular health in overweight and obese children.

【2B-6】

**Anti-osteoporotic Effect of Isoflavone Intake on Bone Mineral Density
in a Female Athlete Rat Model.**

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The aim of this study was to investigate whether soybean isoflavone intake can prevent bone loss induced by energy restriction with voluntary wheel running in female rats. Thirty-five female Sprague-Dawley rats (8-wk old) were randomly divided to two groups, sedentary (SED) group or running (RUN) group. The rats in RUN group were free access to wheels throughout the study. At 18-wk of age, the rats in each group randomly assigned to three groups, ad libitum-fed control (SED, RUN), 30% energy restricted-fed diet (SED + RES, RUN + RES), and 30% energy

restricted-fed diet + Isoflavone (SED + RES + ISO, RUN + RES + ISO), respectively. At 32 wk of age, the BMD of proximal region of the femur in the RUN + RES group was significantly lower than RUN group ($p < 0.05$), but no difference was observed in BMD between RUN and RUN + RES + ISO group. No difference was observed in BMD of proximal region of femur between RUN + RES and RUN + RES + ISO groups. Our study indicated the energy restriction with voluntary wheel running induced bone loss and Isoflavone intake may mitigate bone loss in female athlete rat model.

【2B-7】

Effect of sleep restriction on physical functions.

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This is a report of an ongoing study of which the purpose is of to examine how sleep restriction affect energy expenditure, body temperature and endocrine system. Subjects were 4 healthy young males. Experiment was performed in two conditions (normal sleep condition: NSC, shortened sleep condition: SSC). In the NSC, 7h sleep was taken for 4 nights. In the SSC, subjects took 3.5h sleep for 3 nights following one recovery night sleep. Energy expenditure was measured by a respiration chamber. In both conditions, energy expenditure and core body temperature continually measured for 48h (3rd, 4th, 5th experimental day). Blood was sampled twice on 4th, 5th day in the morning. Overnight polysomnography was examined 3rd, 4th nights'

sleep quality. Psychomotor Vigilance Test (PVT) was examined every 2h on 4th, 5th day in the NSC and SSC. Time of sleep stage 2 decreased and time of slow wave sleep increased by sleep restriction. PVT performance impaired. Number of lapse increased in the SSC. Energy expenditure was lower during the SSC compared to the NSC. Body temperature slightly reduced after continuous sleep restriction. These results may indicated that continuous sleep restriction affect physical functions. Decreased energy expenditure may be related to decreased body temperature. We should be examined these results in combination with the results of blood sample in future studies.

【2B-8】

**Comparison of intensity between lifestyle physical activity of female athletes
and untrained healthy women**

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The aim of this study was to compare intensity of lifestyle physical activity (PA) between female athletes and untrained women. Ten lacrosse players and thirteen untrained healthy women volunteered to participate in this study. The subjects were asked to wear a triaxial accelerometer during waking hours over the measurement period as lifestyle PA, except during training, sleeping, or bathing. Lifestyle PA were classified as sedentary behavior (SED), light-intensity PA (LPA), moderate-intensity PA (MPA), and vigorous-intensity PA (VPA) according to their MET values measured by accelerometer (SED<1.6METs, LPA<3METs, MPA<6METs, VPA>=6METs). Time spent by each intensity of PA and daily step counts were assessed using accelerometer data. Athletes spent lower

percentage of time in lifestyle MPA during the training day than untrained women. Lower percentage of MPA spent in athletes may have driven from small step counts relative to the small step counts of untrained women. Athletes also had lower MET values of MPA and VPA than untrained women. The athletes spent more time on sleep compared to the untrained women. However, there were no significant differences in the average intensity (MET) and the ratio of time spent on each lifestyle PA level, as well as the daily step counts between athletes and untrained women during non-training day. These results suggested that female athletes spent similarly to untrained women during non-training day.

【2B-9】

Effects of exercise and showering on the epidermal physical barrier.

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In the previous study, we suggested that high-intensity endurance exercise might depress epidermal barrier functions. The aim of this study was to determine the effects of high-intensity endurance exercise and showering on the epidermal physical barrier, especially moisture content of the stratum corneum. Seven healthy adult males participated in this study. Each of the participants performed bicycle exercise at 75%HRmax for 60 min (20:30 p.m.-21:30 p.m.). Measurements were carried out at 20:30 p.m.(pre), 21:30 p.m.(post), 22:30 p.m.(after shower), and next morning at 7:00 a.m.(next morning) on two straight days (the first day; Rest, the second day; Exercise). Moisture

content of the stratum corneum was measured by pressed moisture checker against the skin surface. Moisture content of the stratum corneum was significantly lower after showering than that at pre ($p < 0.01$) on the first day and increased at post compared to that at pre ($p < 0.01$) on the second day. These results suggest that high-intensity endurance exercise and showering might depress a physical barrier function on skin surface. From practical point of view, we recommend that athletes maintain their skin surface in good condition, for example, by showering immediately after sports activities and using moisturizing creams.

【2B-10】

Polygenic profiles of elite Japanese track and field athletes

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The purpose of the present study was to identify the polygenic profile determining the potential for becoming a elite sprint/power athlete in Japanese population. 211 sprint/power (track and field) athletes (62 international, 72 national and 77 regional) and 649 Japanese controls were genotyped 22 polymorphisms which have been reported to be associated with sprint/power related phenotypes and are MAF \geq 5% in Japanese population according to HapMap data. Among 22 polymorphisms, genotype frequencies of 5 polymorphisms (rs1815739 *ACTN3*, rs699 *AGT*, rs41274853 *CNTFR*, rs7832552 *TRHR* and rs2228570 *VDR*) differed between international sprint/power athletes and controls at the $P < 0.10$ level. In order to assess the combined effect of these polymorphisms, total genotype scores (TGS) maximal value of 100 for

the theoretically optimal polygenic score) for 5 polymorphisms were determined. Genotype score was assigned at each genotype based on most fitted genetic model and estimated contribution rate of each polymorphism to athlete status. TGS in international sprint/power athletes (59 ± 17 [mean \pm SD]) was significantly higher than in controls (50 ± 15), regional (50 ± 13) and national (51 ± 16) athletes ($P < 0.05$). The receiver-operating characteristic (ROC) curve analysis showed a significant discriminating accuracy of the TGS (AUC: 0.65 [95% CI: 0.57-0.72]). The contribution of the TGS to international athlete status was 6.2%. These results suggest that these 5 previously published polymorphisms partially contribute to international sprint/power athlete status.

【2B-11】

Voluntary exercise preconditioning enhances cFos overexpression caused by heat or salt loading in the mouse hypothalamus

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The aim of this study was to ascertain whether the basal c-Fos expression as well as the increased c-Fos expression in the mouse brain caused by heat exposure and/or salt loading can be affected by voluntary exercise preconditioning. Mice were divided into two groups: one group had free access to running wheel for 8 weeks (exercise, n=30) and the other had no access (sedentary, n=30). After subcutaneous injection (1 ml/100 g of body weight) of either isotonic- (154 mM, IS) or hypertonic- saline (2,500 mM, HS), each mouse was placed in a behavior box with 5 Peltier boards at the bottom, where a) thermal mosaic or b) operant behavior available. When the operant heat escape/cool seeking behavioral setting was unavailable, both the basal c-Fos expression and the increased c-Fos expressions

caused by heat exposure and/or salt loading in the preoptic area/anterior hypothalamus (PO/AH), but not in the paraventricular nucleus (PVN) or in the central amygdaloid nucleus (CeM), of exercise mice were significantly higher than those of the sedentary mice. Additionally, when the heat escape/cool seeking behavioral setting or thermal mosaic was available, both the basal c-Fos expression and the c-Fos overexpression induced by heat exposure and/or salt loading in both the PO/AH and the PVN, but not in the CeM, of the exercise mice were significantly higher than those of the sedentary mice. Thus, it appears voluntary exercise preconditioning induces an upward shift in the basal c-Fos expression and enhances c-Fos overexpression caused by heat or salt loading in the mouse hypothalamus.

【3A-1】

**Facilitators of Engagement in School-based Extracurricular Sports Activity
Among Registrants of Sports Leader Bank**

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Background:

Promoting external coaches' engagement in school-based extracurricular sports activity (SBECSA) is valuable to activate SBECSA. However, the number of external coach has not been enough. To promote engagement of external coaches in SBECSA, it would be an effective way to approach registrants of sports leader bank who are capable to become external coaches. In spite of such a situation, there are few studies to clarify the way to promote engagement of the registrants of sports leader bank

Purpose:

The purpose of the present study was to clarify facilitators associated with engagement in SBECSA among the registrants of sports leader bank who do not act as external coaches presently.

Methods:

Participants were 12 registrants from four sports leader banks who had not engaged in SBECSA as external coaches. Data were obtained through personal semi-structured interviews and analyzed using the KJ method.

Results:

The following four large categories of facilitator were grouped: Benefits (e.g. feeling worth, and growth of team members), System (e.g. compensation, insurance system, and information), Environment (e.g. understanding from the school and SBECSA teacher, and motivation of team members), and Motivation (e.g. coaching motivation, and love for the sport).

Conclusion:

Enhancing facilitators clarified in the present study may contribute to increase external coaches in SBECSA.

【3A-2】

**A study on the starting point of the theory in Physical Education by Toshio Nakamura :
With focus on the formative process of “Nakamura Plan”**

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Toshio Nakamura (1929-2011) was the pioneer who represented the theory of Physical Education after World War 2.

In 1973, he insisted on the curriculum in Physical Education which was called “Nakamura Plan” which was clarified the starting point of his whole theory. This plan was constructed with sciences for developing sport culture. This study explores the characteristic of his thought in the starting point of his theory by analyze the formative process of “Nakamura Plan” which have not been clarified so far. My conclusions were as follows : “Nakamura Plan” had been created through Japan Teachers’ Union and Yasuo Tange who was an establisher of the private educational research group called

Gakkoutaiku-Kenkyu-Doshikai. Through these factors, he acquired the viewpoint that the educational policy by government after World War 2 was reverse course to it before the war. His viewpoint which was theoretical background of “Nakamura Plan”, however, was biased. The purpose of the educational policy after World War 2 was to dissolute the gap of educational environment in countryside. Therefore, the government needed to intervene in this matter. It suggests that there was “binary opposition”, which is the way to define the theory against one another, under the viewpoint. Finally, his thought was also “binary opposition” in the starting point of his whole theory.

【3A-3】

**Applied ethics of pitcher retaliation in baseball: With focus
on the controversy of previous studies in recent years**

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The purpose of this study is to examine the point of previous issues on right or wrong of pitcher retaliation in baseball with a fresh eye. In baseball, the pitcher intentionally pitches at the batter for the violation of implicit conventions. Such behaviors are prohibited by the rule 8.02(d) in “Official Baseball Rules”. On the other hand, these are accepted as custom by players, coaches, and directors. Though a study on right or wrong of pitcher retaliation in baseball has been discussed by scholars, the conclusion has not been attached in the area of sports ethic. In this study, I will focus on the McAleer (2009) and Dixon (2010). The points to be solved are as follows.

1. Players permit preventive self-defense in baseball or not.
2. The intentional pitch for the batter is regarded as a distinctive excellence in baseball or not.

With regard to the establishment of self-defense, I analyzed from the viewpoint of legal philosophy that there is accumulation of the discussion. In the academic field, The presence of imminent and unjust invasion have reached an agreement to the conditions for self-defense. As a result, the situation of pitcher retaliation is not met situation of imminent and unjust invasion. It is future’s task that analyze the distinctive excellence in baseball.

【3A-4】

Factors Encouraging Taiwanese Women's Participation in Leisure Exercise after 1970s

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Confucianism traditionally has a considerable influence on many aspects of the lives of the Taiwanese people. Many studies mentioned that the perception of women according to Confucian values has been limiting women's participation in physical exercise to date. However, belly dance has become one of the most popular exercises in Taiwan in the last 10 years. Dancers consist of a wide range of age groups, and it is often claimed by media and as being healthy for women. This study aims to explore the social backgrounds that have encouraged Taiwanese women's participation in

belly dancing. Method of literary analysis was adopted. This study concluded the social factors influencing Taiwanese women's participation in leisure exercise after 1970s: (1) Equal education opportunities (2) Changing family structure (3) Growth of the national economy and evaluation on leisure exercise (4) Feminist movements, women policy and women leisure (5) Emerging leisure industry (6) Foundation of Sports Affairs Council, Executive Yuan (7) Foundation of community university.

【3A-5】

**A Conceptual Framework for the Development of Chinese Wrestling (Xiang Pu)
in Ancient China**

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China is a country which has a long history and also is consist of many different ethnics. Chinese nations, it generates several of wisdom of many ethnic groups. During the process of continuous creation and improvement, so many material civilization and non-material civilization are appearing. The sport of Chinese nation—wrestling, it is the sport that is reserved by continuous development in different historical period of time. During these period of time, there were many bare-hands fighting sports similar to wrestling which purpose was to the rival down by several kinds of body-contact. Xiang Pu(相扑), Jiao Di (角抵/觥/抵), Jiao Li (角力), Hu Di (彘抵),

Zheng Jiao (争交), Xiang Pou (相掬), Xiang Fei (相费), Chi You Xi (蚩尤戏), Ba Li Su Xi (拔里速戏), Bu Ku(布库), Liao Jiao(撩跤), E Lu Te (厄鲁特) are the names of this sport in the process of development in ancient china. Therefore, the purpose of this thesis is to review briefly the developing process of the Chinese wrestling (Xiang Pu).Through the searching of ancient documents and archeology data, we discover that the bare-hands fighting sport with purpose of throwing rival down is closely similar to Sumo which is very popular in Japan. Also, in ancient china, there was a long period of time.

【3A-6】

The Development of National Traditional Games of Ethnic Minorities of China (1953-2011).

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The National Ethnic Games, initially launched in 1953, have evolved into one of the influential traditional national sporting events with its own distinct characteristics. After being suspended for 29 years, the second games were held in Hohhot, Inner Mongolia, in 1982. Since this year, the event has been held once every four years. There were 9th games were hold until 2011. The purposes in this paper are, 1. How was the development of The Traditional Games from 1953 to 2011? 2. What's the role of the Game played between China Government and ethnic minority groups? The Game spirit refers to Equality, Unity, Struggle and Advance, then, displays the traditional

characteristics of minority ethnics in sport, develops superior athletics and establishes a harmonious society. Feng (2011) the Game in order to display the traditional characteristics of minority ethnics in sport, avoid the disappearance of their traditional culture. Harmonious is an important concept of communist manifesto in China, China government also practiced unity and harmony during the National Traditional Games. Thus, The Chinese National Ethnic Games showcased unity and harmony of the Chinese people with sports events and colorful performance featuring unique traditions of 55 ethnic minority groups.

【3A-7】

Globalization and motorcycle sport in Taiwan

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This study tries to find insights from motorcycle culture in Taiwan, to view its phenomenon as a reflector of economic and social changes. I will then focus on the sportization process of motorcycle sports in Taiwan. Motorcycle racing games was once popular in the 90's, however, due to interests conflicts between members inside motorcycle association, the financial crisis and using rights of circuits, numbers of racing games decreased dramatically. Along with the rooted stigmatized image of motorsports, government didn't pay much attention to its development. Until fairly recent, several racing events start to hold up, again bring in

racers and spectators. Taiwan spirit rider association is among the most devoting private organizations, which expect to provide a better environment for riders and also promote the sports. The association not only holds domestic games, but also develops international communication with associations in Japan. This study thus intend to utilize globalizing theories to investigate the paradigm shift and model transform of motorcycle racing events and its culture among Asian countries, and the process of localizing and emerging new motorcycle culture in Taiwan.

【3A-8】

**The metamorphosis of “the sick man of the East Asia” in the world of Sports:
Judging the bodily discourse in the Chinese Press Coverage
of Foreign and Chinese Athletes**

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The purpose of this research is to conduct content analysis of bodily-related discourse in the Chinese press coverage of Chinese athletes and foreign athletes to test the hypothesis that sports-news discourses express the perceived economic and political status of modern China in the world and her relations with other countries and regions.

In an attempt to interpret the media representation on physical comparison between Chinese and foreign athletes, I intend to search for related sport articles and/or headlines containing the Chinese characters ‘身 (pinyin: *Shen*) and ‘体’

(pinyin: *Ti*). Two Chinese printed sources will be analyzed during the seven summer Olympics that China has taken part in since 1984. The two newspapers that I intend to research are: *Titan Sport* and the *People’s Daily*. *Titan Sport* is the best selling privately owned sports newspaper and the *People’s Daily* is one of the Chinese Communist Party’s (CCP) leading mouthpieces. The case study result of 2011 has revealed that in the selected newspapers Chinese athletes were addressed as physically inferior to foreign athletes but physically superior to fellow Asian athletes.

【3B-1】

Effect of the free play program on mental well-being in children

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Background:

Physical inactivity and mental health problems are recognized as public health concern within children. In the recent years, there has been reported that children in Japan are encountering problems, such as decreasing physical fitness, obesity, and mental health problems. Children's lifestyle has changed along with the environmental change and the increase of study pressure, especially the significant decline of physical activity and increase of mental health problems. According to studies, it has been revealed that physical activity has positive impact on the mental health of children. Therefore, interventions to increase physical activities and reduce the impact of mental health problems are needed. The purpose of this study aims to examine

the effectiveness of the free play program emphasize on the unstructured play to enhance physical activity and to alleviate school children's mental health problem.

Methods / Design:

The study consists of a 13-week intervention. One session a week, and each session has specific goals and includes participatory activities. We are recruiting 4 schools (2 control; 2 intervention), aged 8 to 10 years in each school. The primary outcome of the study including mental health and physical activity measured by self-report, which is assessed at pre- and post-intervention. The control schools have maintained as usual.

【3B-2】

China's university and college sport from 1950s to 1980s: development and reconstruction

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This paper uses methodology of literatures, focuses on two aspects: the construction of China's sport system from 1950s to 1980s, the development and reconstruction of China's university and college sport. After the People's Republic of China founded, China began to learn from Soviet Union in sport, the government designed and constructed sport system for athlete training named *the three-level training system*, consisting of grass-roots sports teams, leisure-time sport schools, and outstanding sports teams, athletes were mainly cultivated by means of the three-level training system that has proved highly effective in encouraging talent. Nearly all of the athletes representing China in the international Games came from the system rather

than university and college sport system. The level of university and college sport was gradually developed to secondary level. Since 1987, China's official started to reconstruct university and college sport system by way of series policies, then, in some higher education institutions, high level sport team were built. The paper conclusions are as follows: the three-level training system that learnt from Soviet Union's sport system improved quickly and effectively China's competitive sport level; University and college sport were excluded from a three-level training system, high level sport team reflected the reconstruction of university and college sport.

【3B-3】

**Correlates of school-based physical activity among Japanese adolescent boys:
A structural equation modeling analysis**

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The present cross-sectional study examined direct and indirect effects of personal, social and perceived school physical environmental factors on school-based physical activity. Japanese junior high school boys (N=379) were invited to complete self-report measures of age, grade, weight, height, self-efficacy and social support from family, friends and teachers for physical activity, and perceived school physical environment (equipment, facility and safety) as well as lunch-recess and after-school physical activity (min/week) occurring at school. Structural equation modeling analysis controlling for age was performed to examine effects of BMI, self-efficacy, support, and physical environmental variables on each physical activity. During lunch recess: self-efficacy exhibited direct effects on

physical activity; BMI, facility, and safety indirectly affected physical activity through self-efficacy; there were no significant associations between equipment and social support on physical activity. During after-school hours: family support and facility exhibited direct effects on physical activity; self-efficacy indirectly affected physical activity through family support; BMI, equipment and safety indirectly affected physical activity through self-efficacy and/or family support. Correlates of physical activity among adolescent boys differed by specific contexts, which implies that interventions to promoting physical activity should be context-specific. Findings encouraged self-efficacy as well as family support to be as potential mediators of intervention effects.

【3B-4】

Development of walking benefits assessment scale

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[Background]

Benefits of physical activity such as environmental benefits have been identified; however, these benefits have not been differentiated and evaluated. What kind of benefits is perceived to trigger walking behaviour is needed to examine. The purpose of this study is to develop a scale which gauges perceived benefits through walking behaviour.

[Methods]

8 factors with 5 items (40 items in total) of benefits in walking behaviour were identified through previous studies and assessed with self-reported questionnaire by 3000 Japanese people aged between 45 and 64. Exploratory and confirmatory factor analyses were utilised for

simplifying the scale. [Results] factors with 3 items (21 items in total) with the acceptable construct validity (GFI=0.942, AGFI=0.921, RMSEA=0.06) were extracted. Moreover, the results of internal consistency (Cronbach alpha =0.80-0.88) suggested this scale has the acceptable reliability. The scores in those who meet 150min/week were significantly higher than those who do not. The reliability of consistent with the test-retest reliability ($r=0.74$, $p<.000$). The

[Conclusion]

The scale of the perceived benefits developed in this research demonstrated acceptable validity, reliability, internal consistency. Thus the scale can be used to evaluate how perceived benefits contribute towards walking behaviour.

【3B-5】

A multifaceted health promotion program on hypertension control in rural China

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The trial's main objective is to determine whether this health promotion program is effective and sustainable in improving the control rate of hypertension at 6, 12 and 24 months from the start of the intervention. The study will employ a randomized, controlled and open label design in subjects with mild to moderate hypertension. The study period consists of an intervention period of 1 year followed by a post-intervention period of 1 year. A total of 500 subjects at 2 communities will be enrolled. The study will randomize one community into the intervention group and the other one into the control group. Participants in the control group will receive usual care. Participants in the experimental group will receive intervention package besides usual care. The intervention

package has 3 main components: 1 Health education; 2 Promoting health behavior (self BP monitoring in self-help groups; salt intake restriction; regular physical exercise); 3 Better family support; Participants in both groups will receive a maximum of 50 yuan as medical reimbursement. The primary endpoint of this study is to compare the control rate of blood pressure using change from Baseline of intervention to usual care. The secondary endpoints are to evaluate the change from Baseline at visit2, visit3 and end of study in self care ability, mental health and family support. These results would show the feasibility of such a multifaceted health promotion program for rural population with hypertension.

【3B-6】

**A community-based intervention study to promote walking in local community:
rationale and study design.**

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Background:

Positive health effects associated with regular physical activity. But, physical inactivity remains a public health problem in Japan. Therefore, it is important for the local government to implement multi-component approaches consisting of informational, behavioral, and environmental approaches for increasing physical activity in population.

Objective:

The objective of this study is to develop a multi-component strategy for community intervention to increase the population of habitual walker in the community. In this presentation, the detail of the research protocol of this study will be provided.

Methods:

A community-based intervention to promote walking in adults will be implemented in 2013 with follow-up study to assess the intervention effects in 2014. The intervention will be conducted using multi-component approaches consisting of informational, social, environmental, and policy approaches. Informational approach is provided by the provision of information to increase awareness and participation in the community based walking activities. Social approach is provided by building a social network for walking circle and an incentive system for walking. Environmental approach is provided by creating walking trails and maps. Policy approach is provided by making health promotion plan based on the partnership between local government and various sectors associated with community agencies and organizations.

【3B-7】

The developed situation of Synthesis Sports Clubs in Japan

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In order to create friendly sports environment for all citizens, Japanese government start to build synthesis sports clubs (SSC) in each communities since 2002. The main goals of SSC are to provide good sports places for the citizens in community to exercise, and to create a sports environment which is available for the participants of any age, gender, and disability, and thus facilitate social activities in SSC. Therefore, the purpose of this study is to examine the developing trajectory of current SSC in Japan. In this research, Nerima District in Tokyo is the main study site. The method of this study was fieldwork investigation in July, 2012 for a month. The results of this study were as followed. First of all, the SSCs were built along with the gymnasium in the communities, so there are 7 SSC in Nerima

by now. In 2000, the Nerima SSC was chosen to be the model sport center which exemplified the practice for other SSCs in Japan. Secondly, in discussing the sport curriculums design of SSCs, those in Nerima tend to focus on providing the gymnastic course, swimming course, and balls course for them. Thirdly, all of the SSCs in Nerima are non-profit organizations. Besides providing physical activities for the sake of improving health condition, SSCs also arrange cultural and educational activities for the citizens to allure more participants. Finally, SSCs require lots of the professionals and human resources to maintain and conduct the facilities and curriculums, some of the staffs are surprisingly to be senior volunteers.

【3B-8】

**Combined associations of physical activity and sedentary behavior
with depressive symptoms among Japanese adults**

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This study aimed to examine combined associations of physical activity (PA) and sedentary behavior (SB) with depressive symptoms among Japanese adults. An Internet-based survey collected data on depression levels (Center for Epidemiologic Studies Depression Scale), self-reported time spent in PA and SB (short version of the International Physical Activity Questionnaire) and sociodemographic variables from 2914 adults in 2009. Respondents were categorized into four PA/SB categories as per public PA guidelines (150 minutes/week) and the median of SB (2,700 minutes/week). Logistic regression analyses examined the odds ratios (ORs) of being depressed (depression scores ≥ 16) according to the categories

of PA and SB. After adjusting for sociodemographic variables, adults in the sufficient PA/high SB (OR, 0.60; 95% confidence interval [95% CI], 0.48, 0.75) and sufficient PA/low SB (OR, 0.60; 95% CI, 0.49, 0.75) category were significantly less likely to have depressive symptoms in comparison with the insufficient PA/high SB category. Similar patterns were found in both men and women. These results indicate that meeting physical activity recommendations is associated with a lower risk of depressive symptoms, regardless of time spent in sedentary behavior. These results suggest that promoting physical activity may be an effective strategy against depressive symptoms in both sexes.

【3B-9】

The analysis of the quantitative evaluation method of group sports skills in soccer game.

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The team performance of soccer and a player's spatial arrangement have an important relation, and spatial arrangement is an important element for strengthening of a team. However, these relations are just analyzed by an expert's visual confirmation method until now and the example clarified quantitatively is not seen so much. Therefore, in this research, all the players' field coordinates are collected from the start of a game to an end, this is treated with basic data. The center of gravity of a team and total of the distance of the position of each player from the center of gravity is computed from

the obtained coordinate data, and observes the temporal change about a team has how much coherence and where it is located. By analyzing the relationship of them and event data (the grade of attack / defense performance, the pattern of transition, etc.), this research aims at clarifying quantitatively causal relationship of a player's spatial arrangement and team performance. It is thought that the relationship between player arrangement and team performance required when evaluating the group sport skill of soccer can be clarified by this research.

【3B-10】

**A study of the relationship between performance and revenue
in the J.League By panel data analysis.**

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The purpose of this study was to examine the relationship between club performance and revenue in Japanese professional football clubs. In Europe, Union of European Football Association (UEFA) decided to introduce financial fair play (FFP) for the purpose of sound management for all clubs. In Japan, J.League decided to introduce club license system from 2013. In this way, through importance for the management of J club increases, the study of revenue and club performance has not been done in Japan. This paper examines, the relationship between revenue and performance in the

J.LEAGUE club making use of analysing the panel data from 2005 to 2009. As a result, in the business income, fixed effect model was selected when time effect was not considered and two-way fixed effect model was selected when time effect was concerned. This implied that there were differences among each club in regional areas and fan characteristic. From the scale of fixed effect, metropolis are not always profitable and there are possibility that the clubs that belong to J2 can more earn expected from club's performance.

【3B-11】

**Key Success Driver of Japanese Elite Sport System:
Elite Athletes' and Elite Coaches' Perspective**

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The purpose of this research was to examine policy-related success drivers of the Japanese elite sport system by conducting an evaluation of the elite sport climate with Japanese elite athletes (n=105) and coaches (n=62) as the survey subjects. The sub-analysis investigated which specific policy-related factors describe the difference between medallist (n=43) and non-medallist (n=62). The study was drawn from the research framework and scoring system developed by De Bosscher et al. (2006, 2008, 2009, 2010) that is built on the SPLISS (Sports Policy Factors leading to International Sporting Success) model. The result showed that the elite sport climate was very well

maintained for the evaluation items of 'training facilities', and this item could be considered to be policy-related success drivers in the Japanese elite sport system. In addition to this, the elite sport climate was not adequately maintained in terms of 'post career support', and this item could be regarded as an underdeveloped area in Japanese elite sport system policies. The sub-analysis revealed that there was no significant difference between medal winning and non medal winning athletes in the overall evaluation of elite sport climate, which suggested that the elite sport climate for medal-winning and non-medal-winning elite athletes are maintained to the same standard.

【3B-12】

Motives of sport spectators: A study of Chinese in Japan

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A great deal of research is devoted to the study of sport spectators' motives; however, the majority of these studies have been dealt with motives of native spectators (e.g., American in the United States, Japanese in Japan). The purpose of this research, therefore, was to explore the motives of sport spectators among a foreign group which was Chinese in Japan. Data were collected using a self-administered questionnaire among Chinese students in Waseda University and TshingHua Alumni Association in Japan from June.19th, 2012 to July.19th, 2012. Based on a literature review, 10 motives were selected for this research: achievement, drama, entertainment, sport interest, aesthetics, socialization, knowledge, group affiliation, escape, and interest in player. Results

showed that achievement, drama, and entertainment were the most important motives for Chinese spectators to watch a game in a stadium. There were no significant differences between male and female spectators. However, analyses of differences between mean scores using ANOVA for different age groups, attendance experience, education background, and length of time living in Japan revealed significant differences on different motives. In particular, this research found that 65.5 percent (Adjusted R²= .655) of the variance in team attachment could be explained by sport interest, interest in player and achievement ($F= 23.584$, $df= 119$, $p< .01$). Finally, implications for sport marketers and limitation of this research were discussed.

【3B-13】

Relationship between the recognition of regional environment change from the demonstration program and the enhancement of the program participant's activities

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The demonstration program, one of the sports events of the National Sports Festival (NSF) in Japan, has been held by the municipalities of the hosting prefectures every year for the residents. Holding the NSF is expected to bring various benefits to the host region; improving community sport environments, regional economic activation and so on. The purpose of the present study was to examine what kind of regional environment change from NSF promoted participant's activity. The data was collected through questionnaires distributed to 849 people (425 effective answers) who attended the demonstration program in 2011 NSF. Independent variables, regional environment change

from the NSF, included 23 items derived from previous studies and NSF official documents. The stepwise logistic regression analysis was utilized, adjusting for gender and age. As a result, to recognize the enhancement of the community sport competitiveness (OR=2.12 ; 95%CI : 1.16 - 3.86), the increase in the opportunity of special sport knowledge acquisition (OR=2.10 ; 95%CI : 1.11 - 3.97), the importance of NFS (OR=2.35 ; 95%CI : 1.32 - 4.19) and the activation of the exchange with residents outside region (OR=2.20 ; 95%CI : 1.23 - 3.92) were positively associated with promoting participant's activity.

【3B-14】

The effect of the delight (Kandoh) experience in watching sport

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The purpose of this study is to understand the effect of the delight experience in watching sport. A questionnaire survey was conducted at the Ajinomoto stadium on 121 spectators of Japan professional football league. The questionnaire required subjects to provide descriptions of their delight experiences, and 140 descriptions were obtained. Content analysis was conducted and the descriptions obtained from the questionnaire were coded. As a result, the effect of the delight experience was clearly classified into four categories. The first category was the effect of “motivation” such as drive and positive thought, the

second was the effect of “updating the cognitive frame of reference” such as changing thought and developing interest, the third was the effect of the “other directed thought” such as human love and tolerance to others, and the fourth was the effect of “psychological health” such as stress relief. The effect of “psychological health” was something that has never been pointed out in previous research, and there was little research relating the positive psychological effects of watching sport. Therefore, the findings of the study contributed to our understanding of the positive psychological effects brought about by watching sport.

【3B-15】

**The effect of leadership behavior on perceived motivational climate
across the athletic season**

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This study aimed to examine the effect of coaches' leadership behavior on the perceived motivational climate created by coaches. One hundred and forty-six players completed surveys twice over the course of the athletic season. The research items included 1) background information (e.g., age, position and years of ice hockey experience), 2) coaches' leadership behavior (performance and maintenance), and 3) motivational climate (task-involving and ego-involving). To examine change in motivational climate over time as a function of the coaches' leadership behavior, a repeated measures analysis of variance (ANOVA) and Tuckey's post-hoc test were conducted for each motivational climate. A median split procedure was employed to classify participants into 4 groups based on their coaches' leadership behavior (i.e., high performance/high

maintenance: PM group, high performance/low maintenance: P group, low performance/high maintenance: M groups, low performance/low maintenance: pm group). The results showed that task-involving climate, is significantly associated with the leadership behavior effect. Specifically, PM group and M group showed a significantly higher task-involving climate compared with P group and pm group. Besides, regarding the time effect, task-involving climate was found to be decreased over time, whereas no significant time-by-leadership interaction was observed. In conclusion, these results highlight that it is important for coaches to exercise the maintenance function of leadership behavior to keep their team's task-involving climate relatively-high standard over the athletic season.

【3B-16】

**Pro-environmental behavior of “new endurance sports” participants
–Focus on triathletes–**

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This study aims to examine the relationship between triathlon specialization and the pro-environmental behavior of participants in triathlon. A few studies clarify the level of specialization related to the environmentalism of outdoor recreationists (Bryan, 2008; Thapa et al., 2006). Specialization is measured by three dimensions: behavioral, cognitive, and affective. Based on their responses on each dimension, participants were separately assigned to three groups: low, middle, and high specializations. To study the differences in the pro-environmental behavior among these three groups we conducted a one-way ANOVA on each dimension separately. The results indicate significant differences with the affective dimension (behavioral $F(2, 261) = 0.07$, n.s.; cognitive $F(2, 261) = 0.81$, n.s.;

affective $F(2, 261) = 4.42$, $p < .05$). In addition, post-hoc analysis revealed that highly specialized respondents in the affective dimension were more conscious of the environment than respondents with low specialization. Hence, indicating that the pro-environmental behavior of NES participants varied with their specialization levels. Particularly, affective specialization with the triathlon was found to be a significant predictor of pro-environmental behavior. However, the study has a few limitations; there were no significant differences among the behavioral and cognitive dimensions. Future studies should use interview based research to reexamine the evaluation of behavioral and cognitive dimensions.