HISTORY OF LABORATORIES IN EXERCISE AND NUTRITIONAL SCIENCES 1956 – Present

Edited by: J.E. Lindsay Carter

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HISTORY OF LABORATORIES IN EXERCISE AND NUTRITIONAL SCIENCES 1956 - Present

Edited by: J.E. Lindsay Carter, with the assistance of colleagues for the Celebration of 100 years plus of ENS.

This is a preliminary report on the development and history of various laboratories in the School of Exercise and Nutritional Sciences at San Diego State University from the mid-1950s to the present. **A history of the Food and Nutritional Sciences Laboratories is presented in Appendix IV.**

INTRODUCTION

In the early decades of the Physical Education Department the emphasis was on teaching at both undergraduate and later at graduate levels. Early research studies were done by Master's theses students – the first was awarded in 1950 – and were largely directed by faculty towards curriculum and topics for school physical education programs. Doing scholarly research was not either desired or expected of the faculty. This started to change slowly after Dr. Frederick Kasch obtained his doctorate in 1956. In addition to his teaching and coaching he developed testing for adults in fitness programs that he started in the mid-1950s. As more faculty with research as well as teaching interests were hired in the 1960-70s, different laboratories were developed. Most laboratories served dual functions as instruction rooms for "Lab courses" in the department, as well as for research by faculty. These changes were also seen in many other departments at what was then called San Diego State College.

Development of the laboratories and areas of research are presented by former and current faculty who were or are involved. The order is approximately chronological. Selected historical and current photos of some laboratories are in Appendices I-III.

Exercise Physiology Laboratories. By Dr. Anthony Sucec.

[Photos in Appendix I.]

Tower of "Women's Gym" – now ENS-400. Dr. Fred Kasch established this small laboratory in 1956 to test some cardiac rehabilitation subjects and early Adult Fitness Program (AFP) members. A step bench was used to test physiological as well as other variables. (Most colleagues in the Physical Education departments were not aware of this laboratory as the tests were usually conducted on a Saturday morning when no other faculty were around.) Oxygen uptake was ascertained via the Douglas bag method, but expired air was collected in Darex meteorological bags which were more adaptable than the somewhat rigid Douglas bags. Chemical gas analysis was made of expired air (V_E) of O_2 and CO_2 using Scholander gas analyzers. Heart rate was determined prior to, during, and following the exercise task by stethoscope. Work rates were based on body weight and stepping rates, which were progressively increased to exhaustion. (Fig. 1.)

With the opening in spring 1962 of the Peterson Gymnasium office and classroom building, most of the Physical Education for Men faculty and Division administrative offices were moved to this building.

Exercise Physiology Laboratory in Peterson Gym Classroom Building. From 1962-1990. This was officially designated as the "**Physical Education Research Laboratory**", but was commonly referred to as the "**Exercise Physiology Lab**". The new location was a room on the northwest of the building's first floor – PG-117. Dr. Fred Kasch was the Director. As the program expanded, so too did the laboratory's operations. Subsequently, the adjacent room PG-115 was altered to serve as a combination classroom-laboratory space. The most significant alteration was the installation of a floor level treadmill. (Fig. 2.) Many notable exercise physiologists (and others) visited the laboratory. (Fig. 3.)

During 1975-76, Dr. James Davis was Director of the Exercise Physiology Laboratory while Fred Kasch was on leave. There were two developments of note: (1) during the fall semester, an underwater weighing tank was fabricated and installed in the laboratory to measure body density, and a Collins respirometer and an N_2 gas analyzer were added; and (2) during the spring semester, a Hewlett-Packard programmable computer was purchased for calculation of VO_2 and VCO_2 from the measurements of expired ventilation and the O_2 and CO_2 expired gas fractions. While the use of the Douglas Bag method (using Darex meteorological balloons) of VO_2 calculation continued, a semi-automated system was installed which allowed continual measurement of V_E – via a Parkinson-Cowan dry gas meter, and Applied-Electrochemistry O_2 and CO_2 analyzers. In the mid-1970s both undergraduate and graduate laboratory courses in exercise physiology were added to the curriculum. These were available for student (e.g. theses) and for faculty research. Figures 4-12 show testing and analyses in PG-115 and 117.

An **interim Exercise Physiology Laboratory** under the northeast stands of the Aztec Bowl, which formerly had served as a locker room for visiting football teams, was established for undergraduate laboratory course instruction in 1985-87. This was to accommodate increased undergraduate curricular demand. The area was abandoned after only two years of service due to rain damage and the of lack funds to make the required repairs.

Exercise Physiology Laboratories in Exercise and Nutritional Sciences. In 1988 funds became available to remodel the old “Women’s Gym” in order to accommodate the office and administrative needs of the entire faculty, and to construct facilities that reflected the current curricular requirements of the Department of Physical Education.

The remodeling was completed in 1990. The new laboratories were located on the east side of the Physical Education building (now named Exercise and Nutritional Sciences), and occupied most of the building’s length from north to south. This laboratory complex (ENS-255) was named the **Kasch Exercise Physiology Laboratory** in May 1990 after Dr. Frederick W. Kasch, a faculty member from 1948 -1981 and leader in the development and use of the earlier laboratories. (Figs. 13-15.)

The space was more than double that of the Peterson Gym classroom laboratories. The concept of the new laboratory was multipurpose. That is, it was to serve as an undergraduate and graduate exercise physiology laboratory, which would accommodate thesis and faculty research, as well as use by non-exercise physiology students and faculty. The most northerly room was an ergometry area where two floor level treadmills were installed. This ergometry area also housed cycle ergometers and desks for the lecture aspect of laboratory instruction. A third treadmill was in the laboratory's climate controlled chamber that was capable of achieving a wide range in temperature and humidity. There was a computer area that accommodated eight microcomputers and two printers; the area also included cabinets to store equipment and oratory references. A small laboratory office was further south with the most southerly rooms for a biochemistry laboratory (ENS-255D) and hydrostatic weighing station (ENS-255F). The Kasch Laboratory is well equipped and can measure most metabolic and cardiorespiratory measures during exercise. In addition, the environmental chamber allows for examination of thermoregulatory measures (e.g. core temperature, sweat rate, skin blood flow, etc.) during heat and humidity. Finally, two equipment and supply areas were located just south of the climate chamber one stacked on the other. (Figs. 16-21.)

A combined **Exercise Physiology/Sports Nutrition laboratory** was opened in 2004 on the top floor of the ENS Annex building after the space was converted from a locker and equipment rooms and expanded to include the Exercise Physiology laboratory, other laboratories and a classroom, as well as a university computer instruction laboratory. The ENS Annex-102 includes a treadmill, various bicycle ergometers, as well as up-to-date equipment for measurement of physiological parameters. Recently (in 2013), a BodPod was added to the laboratory for body composition assessment. The main purpose of the Annex facility was to support graduate student and faculty research. (Figs. 22-24.)

Kinanthropometry Laboratory. **By Dr. Lindsay Carter.**

[Photos in Appendix II.]

In 1964, Lindsay Carter established the Anthropometry Laboratory in the Department of Physical Education, PG-310, on the top floor of Peterson Gymnasium. The room housed the somatotype photography setup, plus strength and flexibility testing equipment (e.g. goniometers, dynamometers, tensiometers), as well as classical and current anthropometric equipment (anthropometers, skinfold calipers), which was used by students and faculty to study body size, shape, proportion, body composition, somatotyping, and growth in relation to physical performance. (Fig. 1.) This laboratory was moved to ENS-273 A-B in 1990 and renamed the **Kinanthropometry** Laboratory. Anatomy models, journals and reference books were available for faculty and graduate students. This laboratory was closed in July 2011. See Appendix II, Figures 1-9.

Electromyography Laboratory. **By Dr. Lindsay Carter.**

In 1967, Lindsay Carter established the Electromyography Laboratory in PG-241, on the East Balcony, Peterson Gymnasium. The first EMG equipment was a one-channel device that was primarily for examining the electrical activity (and relaxation) of single (or a group of) muscles. It required a copper mesh cage around the subject to keep out unwanted electrical signals. The equipment was moved to WG-003 in 1978. A Grass 6-channel EMG console was added about 1980 and was used to demonstrate multiple muscle actions for classes and for student studies. See Appendix III, Fig. 6.

Sports Psychology Laboratory. By Dr. Dennis Selder.

Dennis J. Selder runs, 1979

Dennis J. Selder, 1973

In the mid-1970s, Dennis Selder developed the first Sports Psychology Laboratory, which was located at the corner of Linda Paseo and 55th Street in a modified residence. One half of the building was for Sports Psychology and basketball coaches occupied the other half. A large room was used for group testing and small seminar groups. There were two small testing offices and a room for storing equipment. When the university tore down the Linda Paseo building for new construction about 1992, the laboratory was moved to the current Exercise and Nutritional Sciences Building, ENS-141. This space was smaller, but adequate for small seminars and testing. It also included an office for interviews and storing of confidential information that could be kept locked. The Sports Psychology laboratory was used to gather information from research subjects and clients who were also receiving consultation from faculty and students. The main methods used to gather information were electronic testing, (such as EMG, bio-feedback, and brain waves}, pencil and paper surveys, psychological tests, and interviews. Graduate students and faculty combined processed in excess of 300 individuals per year. Athletes were routinely tested and feedback was provided to the football, basketball, baseball, track and field, and tennis teams at SDSU. In addition, the same services were provided to Community Colleges and High Schools in the San Diego region. The Sports Psychology Laboratory in ENS-141 was closed in 2010 and is now used by the Doctoral Program in Physical Therapy.

Motor Control Laboratory. By Dr. Roger Simmons.

[Photos in Appendix II.]


The West end of the basement area of the ENS-Annex Building, currently referred to as the Motor Control Laboratory (ENS-Annex-003), was part of a concrete lined room that formed the base of the Annex. This area was originally used for Teacher Education classes. In 1978, and with the support of Chairman Dr. Robert B. Carlson, the room (WG-003) was converted into a laboratory space to support classes and research activity associated with athletic training, biomechanics and motor learning. The area was partitioned into several rooms, with one room housing a cadaver (from Biology) that was used by Athletic Training and Anatomical Kinesiology students to study anatomy. A multichannel Grass Encephalograph provided EMG recordings for several classes and studies. Smaller testing areas were self-contained rooms available for research projects and the main floor of the laboratory was used to provide experiences for undergraduate and graduate students. In 1981, some equipment was relocated in the “new” biomechanics laboratory, WG-001, at the East end. Around the same time public health regulations required that the cadaver be moved to biology and consequently athletic training students transferred their studies to this new location.

At this time, WG-003, under the direction of Dr. Roger Simmons, was dedicated to motor control research involving a succession of projects investigating the effects of aging, diabetes and Huntington’s disease on postural control and basic control systems. Beginning in 1997, children with Fetal Alcohol Syndrome Disorder (FASD) became the central focus of a systematic research program completed jointly with a team of faculty and students affiliated with the Department of Psychology Center of Behavioral Teratology under the Direction of Dr. Edward Riley. An initial study investigated postural control in children with FASD, with follow-up projects centered on motor timing and control of isometric and isotonic force. This latter set of studies was supported by two large NIH grants. In 2008,

Dr. Ashkan Ashrafi, Department of Electrical and Computer Science at SDSU, joined the research team and his expertise in advanced signal processing techniques facilitated new insights into how children with FASD generate motor responses. In 2012 a DEXA scanner was installed in one room for bone density and nutrition research by Dr.Shirin Hooshmand. See Appendix II, Figs. 10-11.

Biomechanics Laboratory (1): By Dr. Peter Francis

Peter Francis, 1983

In 1981, Dr. Peter Francis came to the SDSU campus with the specific responsibility of creating a laboratory facility for biomechanics teaching and research. One of the primary tools in the field is a force plate, which must be rigidly mounted in a pit set in a concrete, for a virtually vibration-free floor. The only available room that met that criterion was the basement area of the Annex Building, WG-001, now ENS-Annex-001. The west section of the basement was remodeled to include a dark-room that was used for frame-by-frame analysis of high speed movie film. The remainder of the classroom-laboratory space was fitted with a lighting system to facilitate indoor filming. Initially, all data collection and analysis was carried out with a single Mac Plus computer. Subsequently, a multi-channel EMG system was acquired on extended loan from the Naval Research Laboratory in Point Loma, and a video system that recorded as many as 2000 frames per second was made available on an as-needed basis from a local company, Spin Physics. During the first decade of its existence the biomechanics laboratory acquired additional equipment, including digital video, accelerometer, and force transducer systems. Students also benefited from an ongoing relationship with the Biomechanics Laboratory at San Diego Children's Hospital, whereby they could carry out research using equipment that was not available on campus. After Peter Francis retired in 2001, Dr. James Yaggie (1998-2008) and later Dr. Daniel Cipriani (2005-2011) taught biomechanics and continued the use

of research equipment for laboratories, thesis and research. Jim helped develop the Kinesiotherapy program. Dan, who was also Physical Therapist, did research on flexibility and strength using EMG

Biomechanics Laboratory (2). By Dr. Daniel Goble.

[Photos in Appendix III.]

Dr. Daniel Goble was appointed as the biomechanist in January 2012. He opened up the east and west ends of the laboratory (ENS-Annex-001-003) in order to combine space and resources. The former biomechanics laboratory now serves as a motion capture space with a new 11 camera Qualsys system, 2 force plates, and 16 channel wireless EMG (Delsys Trigno). The former motor control laboratory is now a space for graduate student data reduction, analysis, writing and other computer-based tasks. Testing rooms in the motor control laboratory now consist of:

(1) A balance room set up with virtual reality (video game) training equipment and state of the art balance testing tool - the Neurocom balance manager (donated by the Navy).

(2) A testing room for the balance tracking system (BTrackS), a low cost force plate for balance assessments created for multiple clinical applications such as concussion testing and tracking disease progression.

The name of the laboratory has been loosely rebranded as the Sensory-Motor and Rehabilitative Technology laboratory (SMaRTlab). See Appendix III, Figs. 1-5.

Physical Therapy Program Laboratories

Currently professors in the new Doctorate of Physical Therapy Program (DPT) are establishing laboratories for research and more are planned.

Other Laboratories

Several laboratories, such as **Athletic Training Laboratories** and the **Fitness Clinic**, are primarily for student instruction. Some student research (e.g. for theses) is also conducted in these laboratories.

HISTORY OF LABORATORIES – EXERCISE AND NUTRITIONAL SCIENCES

APPENDIX I

The following photos show early and current views of the laboratories. These accompany the "History of Laboratories" prepared for the 100+ celebration of ENS.

Exercise Physiology: [Photos provided by Lindsay Carter – except Figs. 14, 17-20, provided by Jan Taemans.]

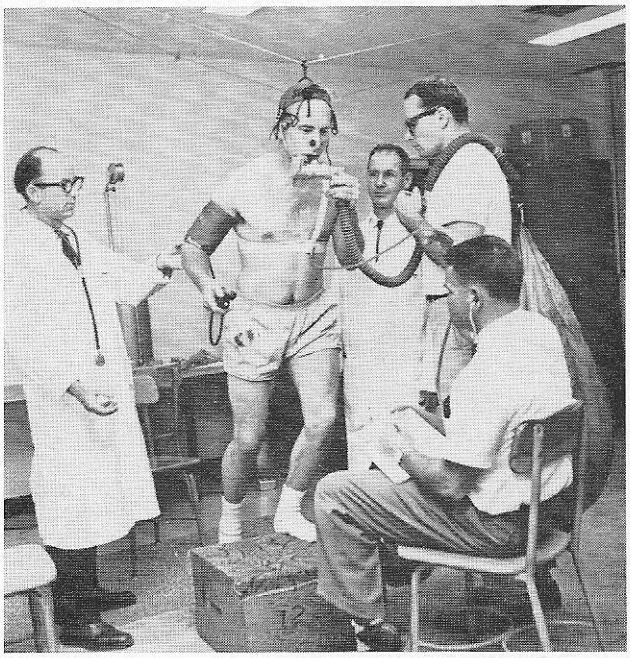


Figure 1. STEP TEST METHOD OF INDUCING MAXIMUM OXYGEN INTAKE. Subject has blood pressure apparatus on right arm, stethoscope harnessed to chest, and ear oximeter held in place by lacing. Lead from earpiece is supported overhead and is carried to oximeter amplifier and recorder, not shown. Exhaled air is collected in Darex meteorological bags with operator shunting from one bag to another.

Figure 1. One of the earliest photos of testing maximum oxygen uptake using the Kasch Step Test, in the Tower of the Women's Gym (WG-400). L-R: Dr. Lindsay Carter, subject Phil Thomas, Dr. Fred Kasch, unknown student, Dr. William Phillips. From: Kasch et al. (1965). Photo probably taken in late 1963 or early 1964.

Figure 2. Treadmill-PG-115-1964. Historic event! The Young model treadmill being installed in PG-115 in September 1964. Metal plates covered the treadmill when not in use. The room was used for testing and for Exercise Physiology Laboratory classes until 2000 when the laboratories were moved to ENS-255.

Figure 3. ASTRAND visit-ExPhysLab-1966. A visit to the Exercise Physiology Analysis Lab (PG-117) by Dr. Per-Olaf Astrand, SWE, who was a world renowned exercise physiologist . L-R: Dr. William Philips, Per-Olaf Astrand, (unknown student at back), Dr. Ash Hayes (Administrator of Health, Physical Education and Athletics for San Diego Unified School District), and Dr. Frederick Kasch. Note the Friden "electro-mechanical" calculator at the left and Scholander gas analysis stations at the back. (Approximately June 1966.)

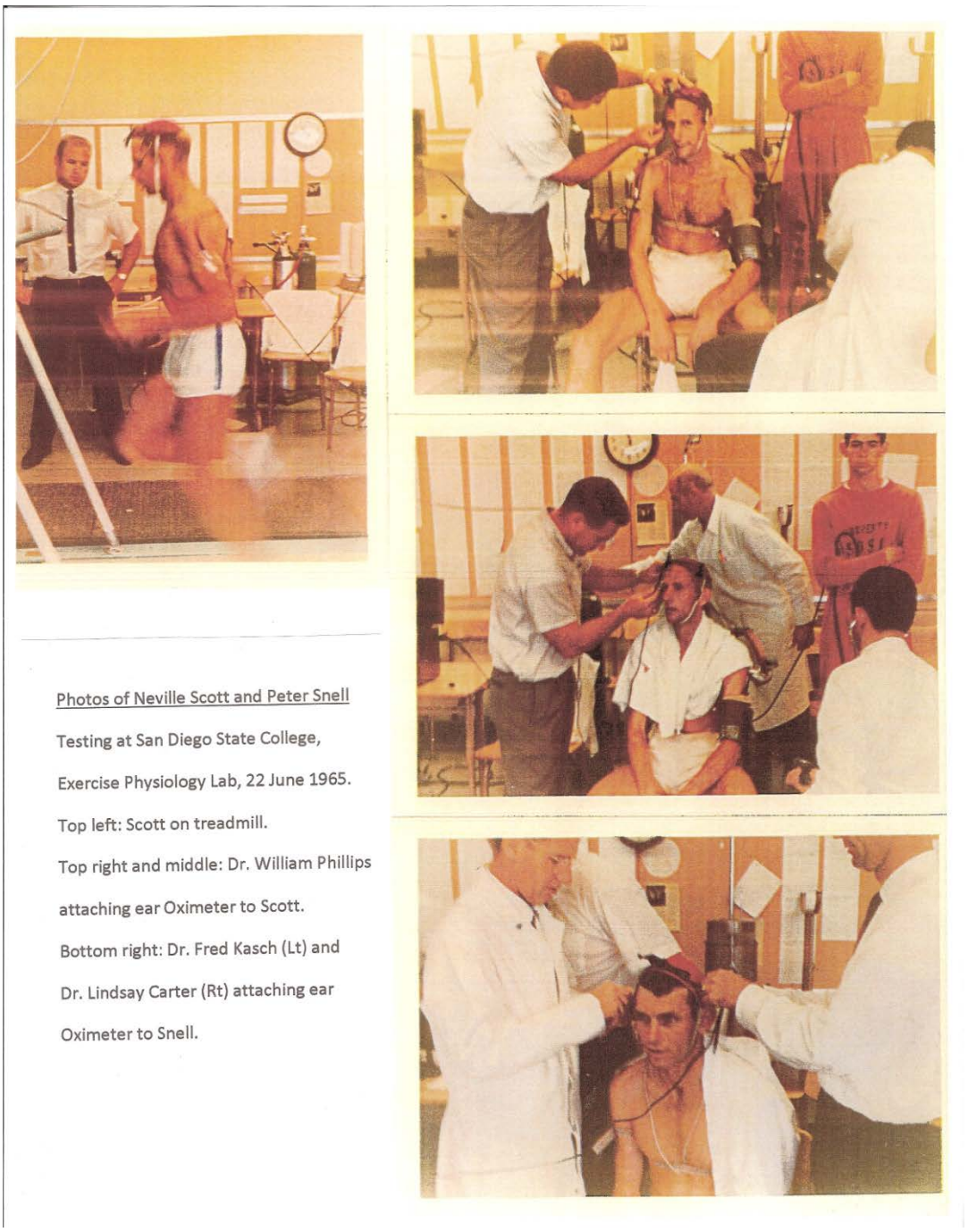


Figure 4. PG-115. Scott-Snell test photos 1965. Peter Snell (800 and 1500 M) and Neville Scott (5K and 10 K) were both world class track distance runners, with world and Olympic records (Snell), and British Commonwealth Games records (Snell and Scott). The results of testing Peter Snell were reported in Kasch et al. (1967).

Figure 5. PG-215. Adult Fitness Program (AFP) participant Dr. William Terry starting his 25-yr VO_2 max test on the treadmill; graduate student LeRoy Neal on "safety watch", 1989. Dr. Fred Kasch routinely tested long-term exercisers in the AFP and this was the 25th year.

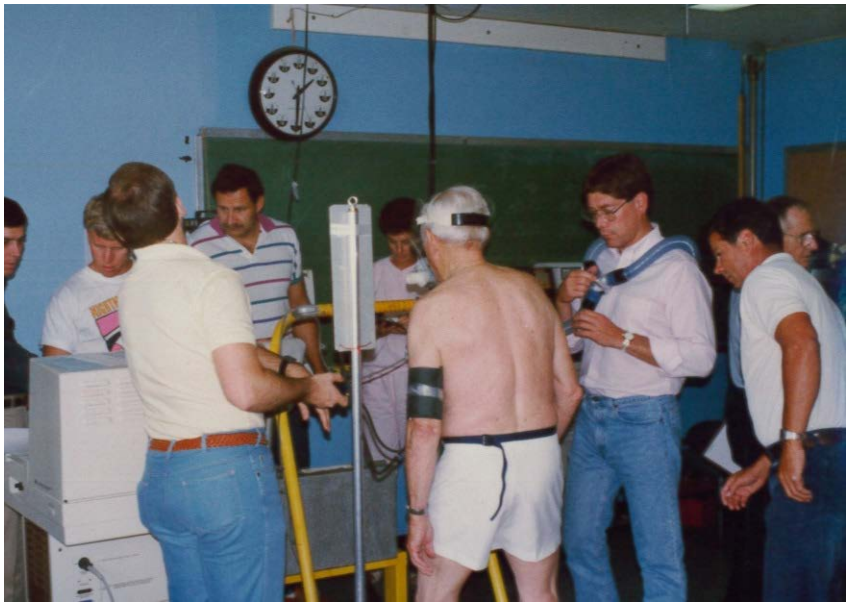


Figure 6. PG-115. William Terry being tested – 25 yr study. Trained graduate students ran the testing. Gary Scherer in striped shirt, Roger Pyes with the expired air tubes and at right LeRoy Neal checking for safety and positioning. Steve Van Camp, MD, cardiologist and medical director of AFP in 1989 is at extreme left.

Figure 7. PG-115. William Terry nearing VO_2 max, AFP-25 yrs. LeRoy Neal monitors William Terry from behind – note incline on treadmill. Phil Thomas checks the Darex balloons.

Figure 8. PG-115. Dr. Jim Davis, Roger Pyes, Dr. Lindsay Carter, Dr. Larry Verity. AFP 25-yr test, May 1989. Lindsay, and a few other subjects were tested longitudinally on a bicycle ergometer.

Figure 9. PG-115. AFP subject warming up on a bicycle ergometer. Dr. Fred Kasch at back, Roger Pyes taking blood pressure. ECG at left.

Figure 10. PG-117. Graduate students James Davis and Kris Mallory using the Scholander equipment for O_2 and CO_2 analysis, 1970. Students were trained by Dr. Kasch to use the Scholander equipment and had to pass rigorous cross-checks. Six Scholanders are shown in this photo.

Figure 11. PG-117. L-R: Dr. Larry Verity, grad student Brad Bjorkman, Dr. Fred Kasch – doing expired air analysis, 1987.

Figure 12. PG-117. Five Scholanders in operation: Lower three: Brent McKenzie, Paul Schmidt, Dr. Mike Buono - doing Scholander expired air analyses, Adult Fitness 25-yr test 1989.

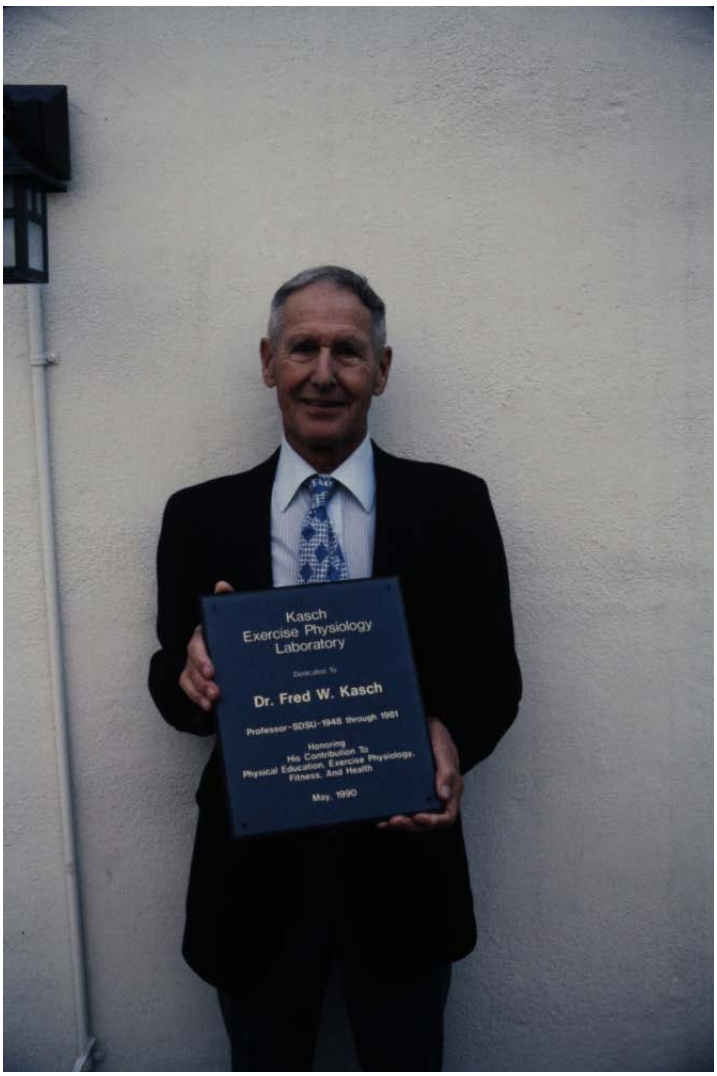


Figure 13. Dr. Frederick W. Kasch with plaque after the ceremony naming the new Kasch Exercise Physiology Laboratory in May 1990.

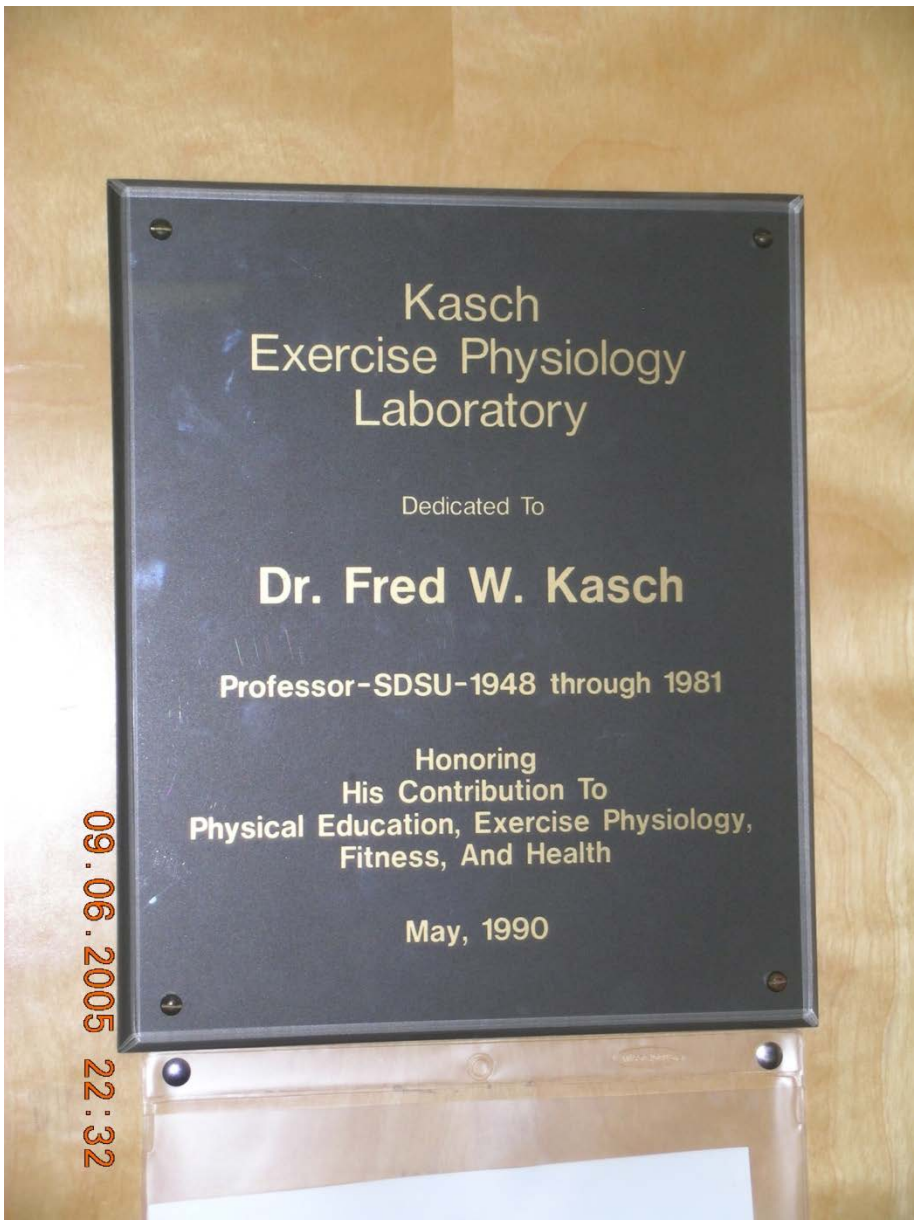


Figure 14. The Kasch Exercise Physiology Laboratory dedicated to Dr. Frederick W. Kasch. Mounted at the south entry to the Laboratory, ENS-255. May 1990.

Figure 15. Dr. Frederick W. Kasch Exercise Physiology Laboratory Opening Ceremony . Top: Some attendees; Middle: Dedication by Dr. Rob Carlson (Dept. Chair); Lower: Acceptance by Dr. Kasch.

Figure 16. ENS-255. “Reunion” data collection-FWK Lab – 33 yr-1997. Adult Fitness Program 33 yr longitudinal testing in 1997 of 15 subjects. Dr. Ralph Grawunder (Physical Education and Health Science) on the treadmill, Roger Pyes with expired air tubing and other former students helping.

Figure 17. ENS-255. Ergometry Laboratory: two treadmills (shown), six friction-braked cycle ergometers, two electrically-braked cycle ergometers, three metabolic carts, and one Douglas bag system. Note the Darex balloons around the far corner wall.

Figure 18. ENS-255. Automated YSI 1500 blood lactate analyzer, used to determine lactate threshold during graded exercise.

Figure 19. ENS-255. Metabolic equipment: Electronic oxygen and carbon dioxide analyzers.

Figure 20. ENS-255B: Environmental Chamber: A chamber in which ambient temperature and humidity can be controlled. Chamber equipment includes a treadmill, electrically-braked cycle ergometer, metabolic cart, and temperature measurement system. Dr Fred Kolkhorst is explaining the equipment to visitors.

Figure 21. ENS-255F: Body Composition Room: Hydrostatic weighing tank, and other equipment. Dr. William Duquet, a visitor from Vrije Universiteit Brussels, Belgium.

Figure 22. ENS-Annex-102. The BodPod is used by students and faculty conducting research that includes body composition assessment. It has been used for studies comparing various body composition methods and studies examining the impacts of diet or exercise on body composition changes. It is a simple, but expensive, alternative to some other techniques, such as underwater weighing, and it requires less skill to conduct tests than anthropometry.

Figure 23. ENS Annex-102. Exercise testing machines. Left: bicycle ergometer; Center Back: A ParvoMedics Metabolic cart used to measure oxygen uptake and energy expenditure; Center Front: eliptical ergometer; Right: stair-stepping ergometer.

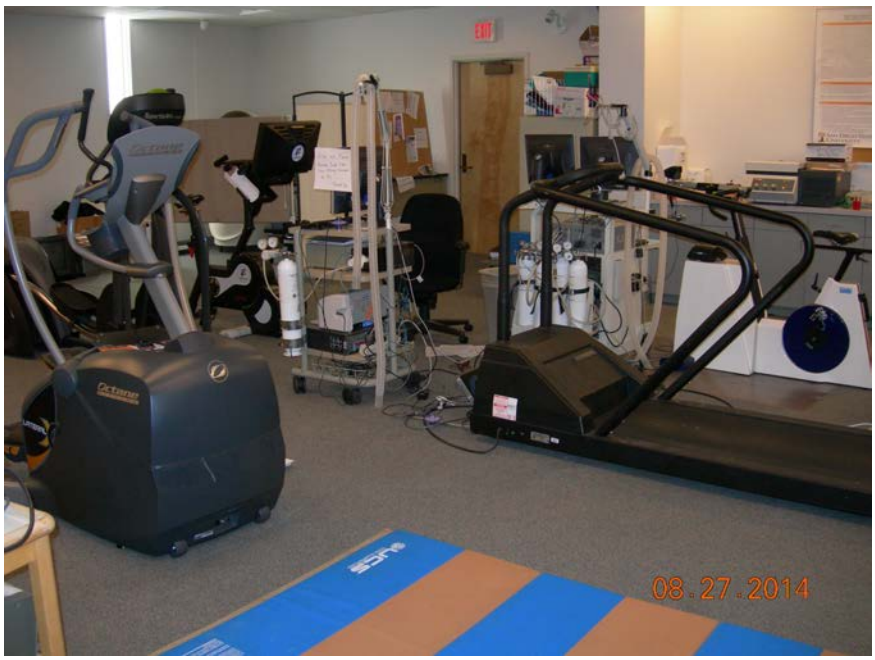


Figure 24. ENS-Annex-102. Exercise testing machines. Left: stair-stepping ergometer; Right: treadmill.

HISTORY OF LABORATORIES – EXERCISE AND NUTRITIONAL SCIENCES

APPENDIX II

KINANTHROPOMETRY LABORATORY

Figure 1: Anthropometry Lab-PG310-1964-5. The Anthropometry Laboratory (PG-310) was located on the top NE floor of Peterson Gymnasium. It was developed by Drs. Lindsay Carter and William Ross. It housed strength and flexibility equipment, including a back and leg dynamometer (left center), and cable tensiometers (on table). These were commonly used in fitness testing. Anthropometric tapes, sliding calipers, skinfold calipers (on table), weight scale (right side) and stature board were also available. The somatotype photo setup included the pedestal, ID board, background screen, and the somatotype camera and flash unit. The Camera was a Rembrandt portrait camera (Burke and James, Chicago, IL.) with an adapted 3-position sliding back for the film holder. It used 5x7 inch negative film (from which contact prints were made). The sliding film holder was moved between each photo to provide the front, side and back views of a subject in the “standard somatotype photograph pose”. The subject was rotated on the pedestal by an assistant.

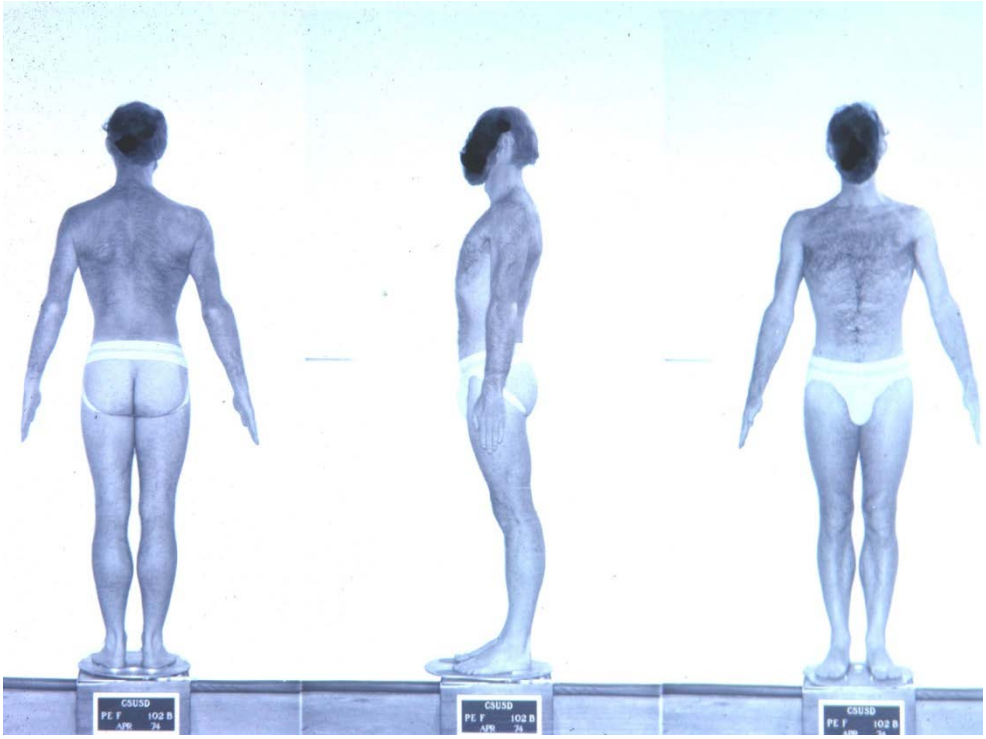


Figure 2: Somatotype photograph taken with equipment shown in Figure 1. The somatotype rating of this subject is 2-5-3.5.

Figure 3: Somatotype photograph taken with equipment shown in Figure 1. The somatotype rating of this female subject is 4-3-4.

Figure 4: ENS-273-Kinanthro Lab-1992 – Entry sign for the Kinanthropometry Laboratory ENS-173 A-B.

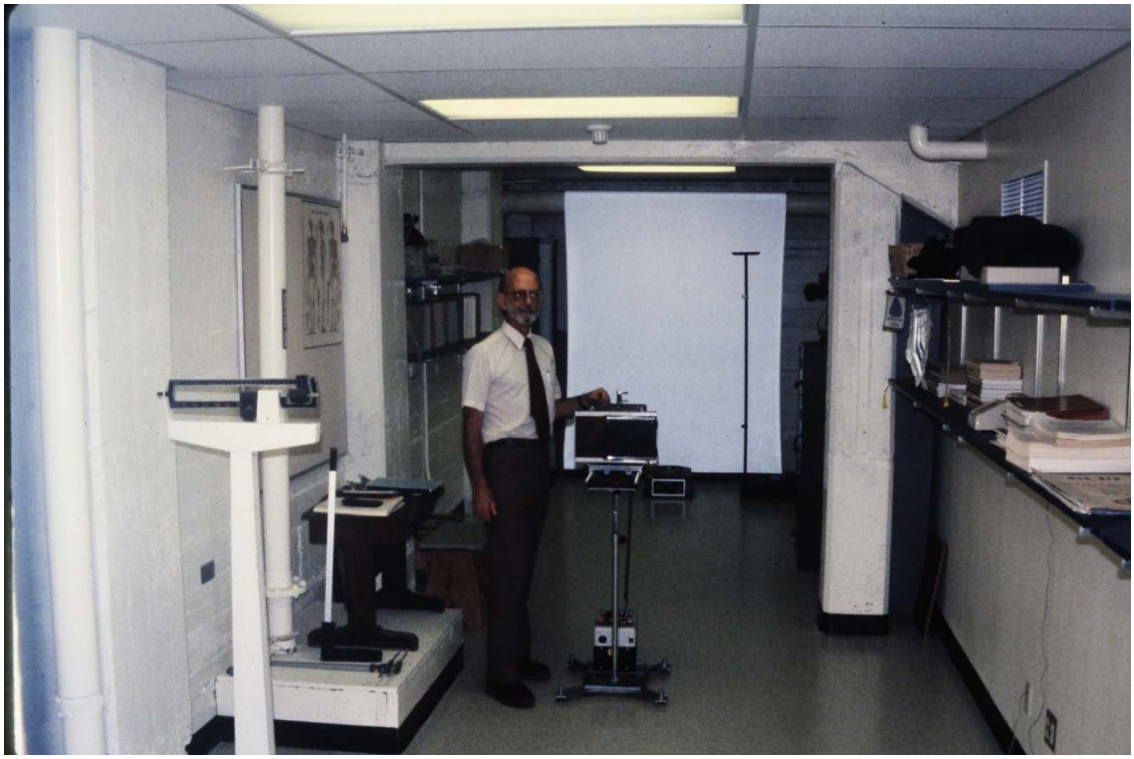


Figure 5: ENS-273-B Anthro+Stype. The new Kinanthropometry Laboratory 273-B in ENS. Dr. Lindsay Carter stands next to the somatotype camera. Anthropometric equipment is seen at the left and the shelves contain reference books and journals.

Figure 6. ENS-273-A. Computers+storage. The entry room to the Kinanthropometry Laboratory. Computers were available, and anthropometric equipment, strength equipment, anatomical models and reference books were in the cabinets.

Figure 7. ENS-273. Kinanthro Equip-Centurion Kit. The Centurion Kit (Rosscraft) is used extensively in kinanthropometry for both field and lab studies. It includes skinfold calipers, sliding calipers, tapes, segmometer, and head board.

Figure 8. ENS-273-Kinanthro Equip-Tom Kit. The Tom Kit (Rosscraft) is used for a limited anthropometric profile. Included are a Skinfold a small sliding caliper, tape measure and Skinfold caliper.

Figure 9. Examples of four anthropometric measurements taken on the upper arm. Top L: triceps skinfold; Top R: biceps skinfold; Low L: arm girth - relaxed; Low R: arm girth – flexed and tensed. In: Ross et al. (2003), Anthropometry Fundamentals (CD).

Figure 10. ENS Annex-003 Motor Control lab test. Dr. Roger Simmons demonstrating a motor performance test with EMG and timing equipment in the background.

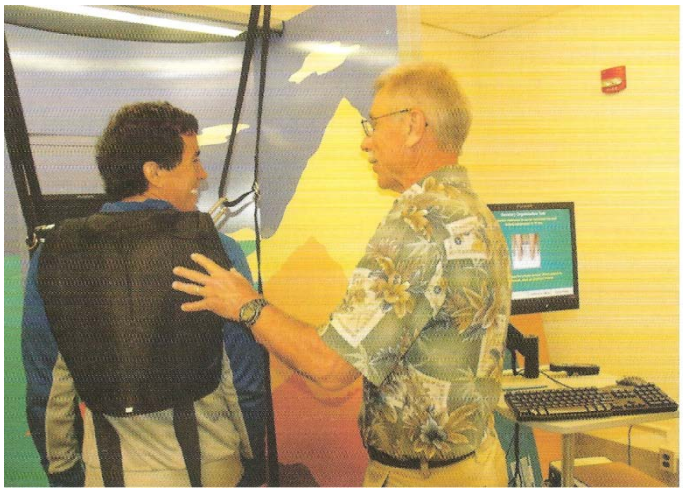


Figure 11. Dr. Roger Simmons administering a balance control test on special apparatus.

HISTORY OF LABORATORIES – EXERCISE AND NUTRITIONAL SCIENCES

APPENDIX III

ENS: BIOMECHANICS LAB PHOTOS – 2014 – ENS-Annex 001. (By Dr. Dan Gable)

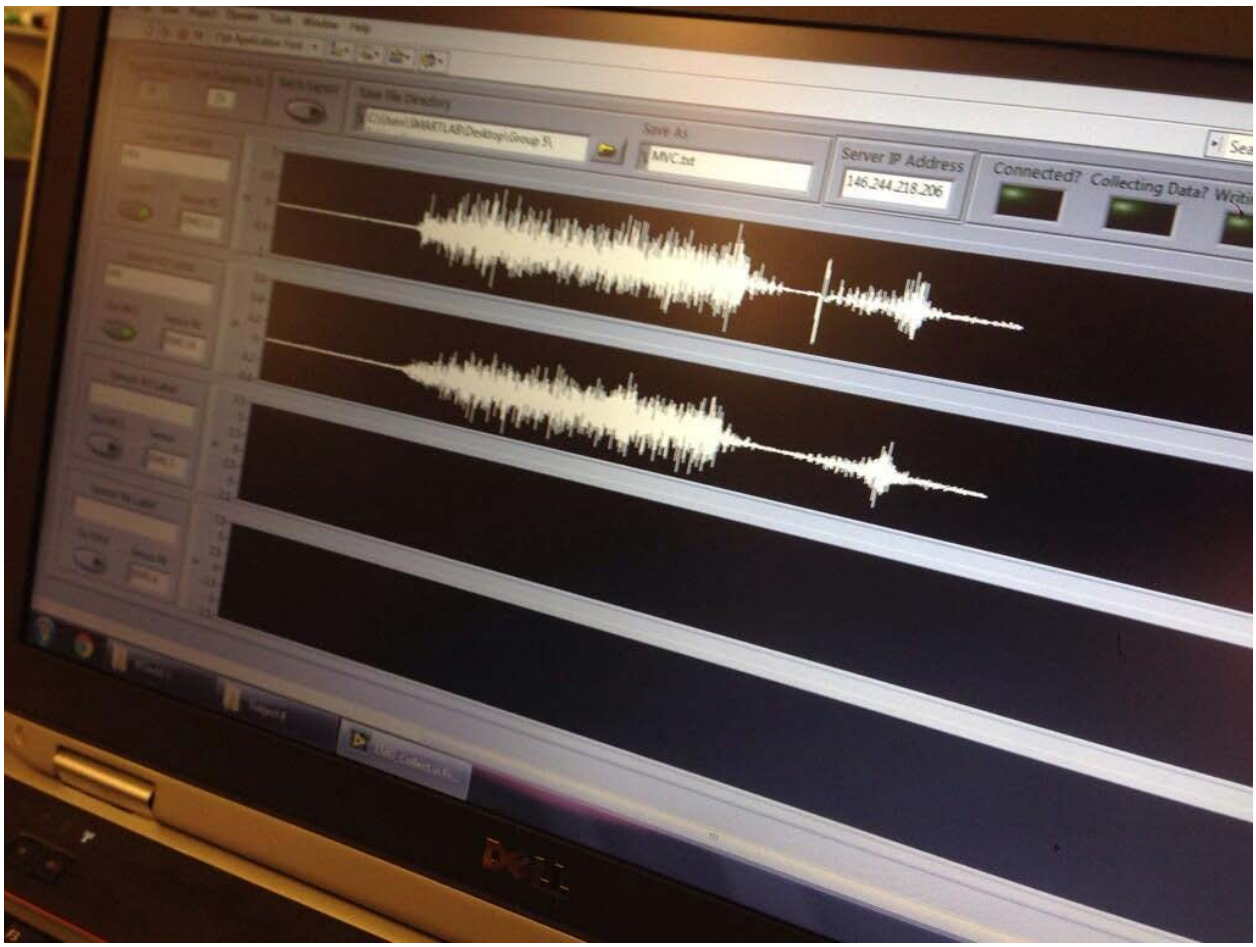


Figure 1: EMG recordings from study of leg muscle fatigue. Data derived using wireless EMG electrodes from the Trigno System by Delsys. Software custom designed by SDSU rehabilitation science alumni Tomas Gonzalez.

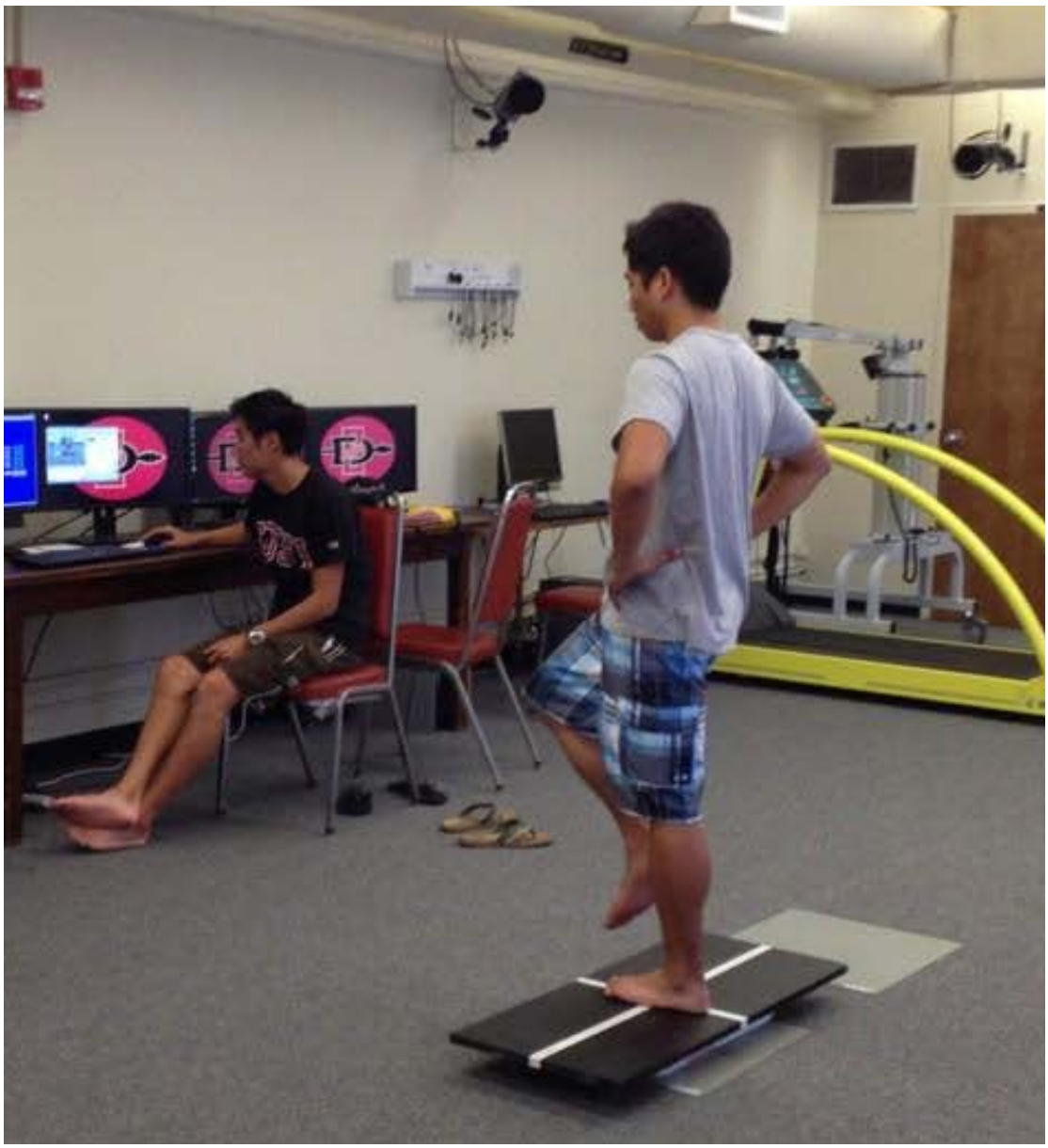


Figure 2: Validation testing of the “Balance Tracking System” created by Dr. Goble. The system is a low cost but highly accurate force plate for measuring body sway. Current applications of the device include concussion testing, fall risk assessment and monitoring of the transition to Huntington’s Disease.

Figure 3: Graduate students working in the “SMaRTlab”.

Figure 4: Dr Goble testing out a proprioception protocol developed in ENS-Annex-001. This device consists of a motorized lever integrated with a hardware controller from National Instruments. Software is custom designed for the measurement of elbow angle.

Figure 5: SDSU student research on kinesio-tape protocols. Muscle activity was determined with and without kinesio-tape using the Delsys Trigno wireless EMG system.

Figure 6. EMG-Equip+cage-1967_PG-220. (Photos provided by Lindsay Carter.)

The first EMG equipment in PG-220, north east end of the 2nd floor balcony in Peterson Gym. Left photo: Electrical testing equipment and the EMG controls and monitor. Right photo: Subject in a copper wire mesh cage which screened out electrical artifacts. This type of equipment was designed by Dr. Herbert De Vries, USC, for single electrode muscle group activity in relaxation or stress of the subject. A grant to Dr. Lindsay Carter in 1967 was used to buy the equipment. It was in use for about 12 years before the Grass multichannel EMG equipment was purchased.

APPENDIX IV

HISTORY OF LABORATORIES IN EXERCISE AND NUTRITIONAL SCIENCES

1956- PRESENT

Food & Nutritional Sciences Laboratories

Prepared By: Dr. Ron Josephson and Dr. Mark Kern

Introduction: Two Teaching laboratories & auxiliary storage rooms for teaching food & nutritional sciences courses were constructed in 1957-58 in what was then called the Home Economics building, located at the northwest end of campus. The building would become the School of Family Studies & Consumer Sciences in 1972-73.

The labs were primarily used for food science and foodservice laboratory classes and seating was available for lectures in the room. The rooms were equipped with full kitchen units, food preparation supplies, some laboratory balances & food testing equipment, and related supplies. Later, the labs were equipped with chemical exhaust hoods. Also, there was a small auxiliary laboratory room in a lower floor for graduate food & nutritional science lab classes and research. It was equipped with laboratory supplies, kiln, lab balances, pH meter, spectrophotometer, along with a chemical exhaust hood.

The laboratories were very limited in equipment, but were improved in 1976-78, when faculty received a National Science Foundation instructional scientific equipment grant ($12,200) to improve undergraduate foods and nutritional sciences instruction. Not until then were faculty and graduate students able to conduct research in these facilities. At that time, new faculty, Dr. Ronald Josephson and Dr. Audrey Spindler, and their

graduate students conducted research in those facilities, and also utilized laboratories of research colleagues in the Departments of Chemistry, Biology, Natural Sciences, & Physical Education. Nutrition researcher Dr. Jane Hoover-Plow arrived in 1980 and also began research collaborations on campus.

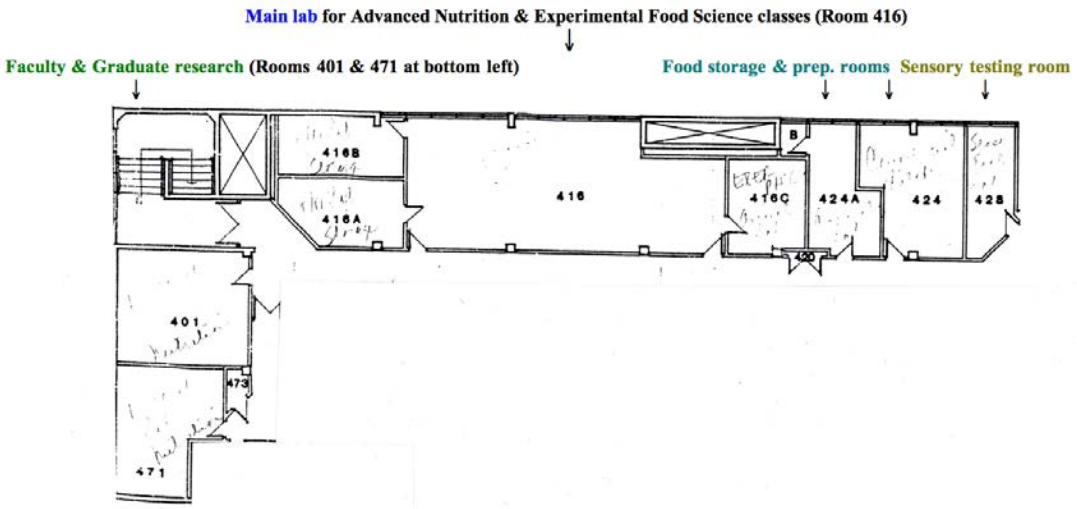
(Note: none of the laboratories in the old Home Economics/Family Studies & Consumer Sciences (FSCS) building exist today (2014). FSCS was replaced by the current Arts and Letters Building. A new foods lab and a tech room were built in West Commons to make up for the loss of the foods lab in FSCS.)

A dramatic change and improvement in laboratory teaching and research occurred between 1982 and 1984 with the renovation of the old library building to the Professional Studies & Find Arts (PSFA) building. Contemporary laboratories were included for food & nutritional sciences instruction and research on the third floor. Faculty (Josephson and Spindler) were consulted in developing and planning the laboratories and they worked with the architects. Planning had to take into account that the building renovation project was done in an existing building, so it was a challenging process. All facilities were built to meet OSHA standards. The building has central air conditioning. De-ionized water lines were installed to support labs. All labs had chemical exhaust hoods and gas, air, & water lines. These laboratories remain today (2014) for teaching and research in the School of Exercise and Nutritional Sciences.

Concurrently, in 1983-84, the CSU Chancellor’s office approved the re-titled undergraduate major (B.S. degree in Foods & Nutrition) and the M.S. degree in Nutritional Sciences. These were changes from the old affiliation with the degrees in Home Economics.

Brief Summary of PSFA lab facilities for food and nutritional sciences teaching & research (See Figure 1 for schematic Floor Plan):

Figure 1. Floor Plan of Food & Nutritional Sciences Laboratories in the PSFA Building



PSFA 416: This lab is a large wet lab, similar to labs in Chemistry & Biology, with three smaller adjacent rooms for storage and specialty food & nutritional analysis equipment. Advanced lab classes in nutrition and food science are taught in this facility. At times it is used for testing and analyses in research by graduate students and faculty. Adjacent rooms (PSFA 416A, 416B, & 416C) are used for support of lab activities in the main lab. Included in PSFA 416 & adjacent labs are specialty equipment for testing of lipids, protein, & crude fiber, a calorimeter, a texture analyzer, vacuum freeze dryer, drying ovens, muffle furnace, spectrophotometers, hygrothermograph, pH meters, electronic balances, and other equipment.

Figure 2. PSFA 416 is the main student laboratory for teaching advanced nutrition and food science classes.

Figure 3. PSFA 416b (at left) and 416a (at right) are used as auxiliary labs.

PSFA 424: This room is used to store and prepare food ingredients and food products for lab testing and both human and animal research. Included are commercial grade kitchen equipment (refrigerator & freezer, convection oven, mixer), a stove, a microwave oven, and kitchen supplies. This facility supports advanced nutrition and food science class needs as well as research activities.

Figure 4. PSFA 424 is used as a food storage and preparation facility. Sliding windows on wall (at right) serve sensory booths in adjacent room PSFA 428.

PSFA 424A: In 1992, this room was renovated and closed off from PSFA 424A, so that lab mice could be housed and used for class & faculty research. Today (2014) all lab mice are housed in the SDSU Vivarium. This room houses multiple refrigerators and freezers for storage of chemicals and samples.

PSFA 428: Adjacent to the food preparation area is a sensory evaluation lab with five individual testing booths. This room provides a controlled environment for sensory testing of foods for food labs classes and research.

Figure 5. Sensory booth shown in PSFA 428.

PSFA 401 and PSFA 471: These are graduate and faculty research labs and work areas to support nutritional and food science research. They are also equipped with chemical exhaust hoods and specialty equipment for research, such as electrophoresis, HPLC, real-time PCR, gene amp thermal cycler, chemi-doc image analyzer, UV and fluorescence microplate readers, spectrophotometers, microscopes, atomic absorption spectrometer, etc.

Over the past 30+ years, many research projects, including grant-funded research (NIH, U.C. Sea Grant, corporate-sponsored, American Heart Association, multiple food boards) have been conducted in these facilities. Among the faculty who have carried out research were Dr. Audrey Spindler, Dr. Ron Josephson, Dr. Jane Hoover-Plow, Dr. Becky Matheny, Dr. Jill Ellis, Dr. Michael Kelley, Dr. Mark Kern, Dr. Donna Beshgetoor, Dr. Mee Young Hong, and Dr. Shirin Hooshmand, and numerous graduate students working with the faculty.

Figure 6. Food & Nutritional Sciences research laboratories: PSFA 401 (at left above) and PSFA 471 (at right above). High Performance Liquid Chromatography (HPLC) research equipment is shown (below) in PSFA 471.

WC 203: A state of the art foods lab was developed in Spring 2004 when the University took over the old FSCS building for Arts and Letters. This lab and its auxiliary support room co-function as an undergraduate foods lab and a metabolic kitchen. The lab is equipped with six stations each having three induction cook tops, a bank of commercial convection ovens, a demonstration table, food storage facilities, and "smart" classroom technology.

Figure 7. WC 203 is a food science laboratory and classroom.

WC 202: A tech room corresponding to WC 203 was built at the same time. It serves as office space for the foods and nutrition technician and as a storage facility for laboratory foods and ingredients used for class and research purposes.

Figure 8. WC 202 is used for food storage area and technician support.

ENS 102: In the late 1990's, the equipment room in the ENS Annex was converted to a shared laboratory for nutrition and exercise physiology faculty and graduate students. This space was later expanded and renovated and named the Sport Nutrition and Exercise Science Lab. This lab is used for conducting human trials for both exercise and resting conditions. It includes treadmills, cycle ergometers, metabolic carts, lactate analyzers, an ultrasound, food storage facilities, and other equipment.