The Progress of Physiological Anthropology in Japan*

Masahiko Sato

President of Japan Society of Physiological Anthropology

Japan Society of Physiological Anthropology started as "The Conversazione of Physiological Anthropology" in 1978. The start of this group well reflected the activities in the field of physiological anthropology in those days. The research themes and the numbers of researchers in this field were expanding steadily. Fifty one researchers were enrolled at the beginning of the conversazione. This group grew up to "The Research Society of Physiological Anthropology" in 1982 and developed to "The Society of Physiological Anthropology" in 1987. In 1993 the term of "Japan" was added in accordance with the establishment of German Society of Physiological Anthropology. The membership increased markedly and now reached to 942 including 31 foreign members, which is larger than that of Japan Society of Physical Anthropology (Fig. 1).

The Society began to publish a scientific journal entitled "The Annals of Physiological Anthropology" in 1983. This official journal started as an annually and changed to a quarterly in the next year, and developed to a bimonthly journal in 1992. Now, the annals is financially supported with a grant from the Ministry of Education and is indexed by Biosis, Index Medicus, Ergonomics Abstract, JICST etc.

The annals allowed to contributors to select either Japanese or English for their articles. It might limit the distribution of the annals out side Japan. So, this journal is going to change to an international English language journal from 1995 under the name of "Applied Human Science-Journal of Physiological Anthropology" in order to stimulate international circulation.

Japan Society of Physiological Anthropology also has published a magazine entitled "PA News" since 1991 in order to promote information exchanges and to deepen ties between the members. The PA news has changed from a quarterly to a bimonthly since 1992 and it has no restriction on language usages.

The Society holds general assembly twice a year. Each assembly consists of several symposia, oral sessions and the others. Table 1 shows the titles of symposia and the numbers of oral papers with the names of organizers of the assemblies in these five years. As shown in titles of the symposia, which were decided by each organizer, the research activities of the members have extended to various aspects of man living in the modern technological civilization. This tendency is much more marked in the papers of oral sessions, though the titles of them are too voluminous to show in

Fig. 1 The membership of Japan Society of Physiological Anthropology increased remarkably.

* This article was presented at the plenary session of the Second International Congress of Physiological Anthropology held at Kiel, Germany in September 12, 1994.

Table 1 General Assembly of Japan Society of Physiological Anthropology in these five years.

24th general assembly(organizer: Prof. K. Sakamoto) 4–6 Jun. 1990 in Tokyo plenary presentation: Future problems in man-computer inter- face 1st symposium: Future image of the handicapped and rehabili- tation tools 2nd symposium: How to cooperate man and robot? 3rd symposium: The limitation of human body function oral sessions: 30 papers	man-made spaces oral sessions: 41 papers
25th general assembly(organizer: Prof. S. Koga) 21–22 Sep. 1990 in Kobe plenary presentation: Energy metabolism and alveolar gas exchange 1st symposium: Design and human factors 2nd symposium: Free time and human physiology oral sessions: 22 papers	29th general assembly(organizer: Prof. Y. Nakane) 19–21 Nov. 1992 in Osaka 1st symposium: Characteristics of human amenity 2nd symposium: Modernization of life pattern and its problems pre-symposium: Sports for active health oral sessions: 110 papers
26th general assembly(organizer: Prof. S. Ohno) 2–5 Jun. 1991 in Tokyo plenary presentation: Situation and problems of aged people welfare in Japan 1st symposium: How to live long life? 2nd symposium: "bulimia" and "anorexia" satellite-symposium 1: Evaluation of human amenity satellite-symposium 2: Living culture as a field of science oral sessions: 33 papers	30th general assembly(organizer: Prof. S. Iizuka) 4–6 Jun. 1993 at Hachioji city plenary presentation: Man's future 1st symposium: How to wrap human body 2nd symposium: Expectancy of physiological anthropology pre-symposium: Situation and tendency of the study on human amenity oral sessions: 75 papers
27th general assembly(organizer: Prof. K. Kawakita) 3–6 Oct. 1991 in Fukuoka plenary presentation: Urgent problems in physiological anthro- pology 1st symposium: Safty and behavioral pattern 2nd symposium: Life and living support technology pre-symposium: Man-oriented environment and society post-symposium: 21 century and physiological anthropology oral sessions: 53 papers	31st general assembly(organizer: Prof. T. Ochifuji) 24–26 Nov. 1993 in Sapporo plenary presentation: Problems for human environment in 22 century 1st symposium: Evaluation of smell in room 2nd symposium: Human adaptability to closed spaces pre-symposium: Comfortable heating system and energy conser- vation oral sessions: 55 papers
28th general assembly(organizer: Prof. T. Akamatu) 6–7 Jun. 1992 at Mitaka city 1st symposium: Scientific concept of beauty 2nd symposium: Technological support for the amenity in	32th general assembly(organizer: Prof. Y. Kikuchi) 24–26 Jun. 1994 at Chiba city plenary presentation: Originality and Japanese 1st symposium: Man in 21 century 2nd symposium: Human amenity in urban environment 3rd symposium: Physiological mechanism of amenity oral sessions: 66 papers
	33th general assembly(organizer: Prof. T. Tamura) 5–6 Nov. 1994 in Tokyo plenary presentation: Brain and mind 1st symposium: Amenity and health 2nd symposium: Man; food · nutrition · health oral sessions: 53 papers

Table 1.

The society has research branches on specific items in order to sharpen the focus of activities. Each branch carries on its own meetings. Until today, we have nine branches for the following research items; human comfort, man-made environment, design, physical fitness, body function measurement, office, clothing, nutrition, dwelling environment evaluation.

The Society frequently holds seminars of physiological anthropology for technicians, architectures, designers, or researchers in other fields in order to respond to their demands for learning human characteristics. This activities started from 1989 and a total of 22 seminars was held until October of 1994 (Table 2).

These recent trends such as the increases in membership, two bimonthly publications, biannually holdings of general assemblies, nine branches, seminar activities mean substantial progresses of physiological anthropology in Japan. This also may suggest the capacity of this science for further developments.

These trends seem to be derived from the characteristics of anthropology itself as well as the man-oriented inclinations in general tendency of the present society.

Physiological anthropology in Japan has had a long history of progress. For example, "Hitachi no Kuni Fudoki (The history of natural features of Hitachi region)", which was published in 713, has been considered to be one of the oldest anthropological publications over the world. The eighth volume of "Zoku-Nihongoki (Sequel Japan history)" is also an old literary composition published in 839. These books have descriptions extended to even the regional differences in daily life pattern or human physique as well as detailed records on the shell mound or stone implements such as flint arrow-heads.

A new epoch of anthropology in Japan was marked in the end of 19 century. The first anthropological laboratory was founded in Tokyo University in 1886. Before that, an association for anthropologists had been established under the name of "Jinruigaku no Tomo (Group of Anthropologists)" in 1884. Although various problems in the fields of anthropology were investigated in the Anthropological Laboratory and discussed in the "Jinruigaku no Tomo", the foci of researches and discussions were different from those of the present physiological anthropology. In anyway, both the institutions

Fig. 2 Professor Toshihiko Tokizane (Sept. 4, 1909~Aug. 3, 1973)

promoted systematic researches of anthropology and contributed to develop this science. The Jinruigaku no Tomo, which was founded 25 years after the foundation of Paris Anthropological Society by Dr. P. Broca and 16 years after that of German Society of Anthropology by Prof. R. Virchow, is a distant antecedent of Japan Society of Physiological Anthropology.

The anthropological laboratory developed to the department of anthropology, faculty of science, Tokyo university in 1939. "Das Lehrbuch der Anthropolopogie" by Prof. R. Martin was one of the most influential books in those days. Beside morphological anthropology or prehistory, physiological anthropology was regarded as a main realm of anthropology. However, at that time, there was no adequate person in the department of anthropology for the leader of this realm. After a long vacancy, Dr. Toshihiko Tokizane (Fig.2), lecturer of department physiology, faculty of medicine, was asked to fill up this position. It was an event occurred in 1948.

Table 2 Seminars by Japan Society of Physiological Anthropology.

- 01) How to build up office amenity (June 1989)
- 02) The profile of future office (Jan. 1990)
- 03) Physiological Anthropology for clothing materials (June 1990)
- 04) Scientific system of living culture (Jul. 1990)
- 05) How to evaluate human comfort (Dec. 1990)
- 06) Living culture as the key of business strategy (Jan. 1991)
- 07) New office (May 1991)
- 08) Industrial design in near future (June 1991)
- 09) Design concept (Nov. 1991)
- 10) The amenity of light and color (Jan. 1992)
- 11) The amenity of the dwelling (Mar. 1992)
- 12) Sensory mechanism for the amenity (Jan. 1992)
- 13) Physio-anthropological design (Sep. 1992)
- 14) User satisfaction on office (Nov. 1992)
- 15) Human comfort and health in man-made environments (Jan. 1993)
- 16) Science on the amenity (May 1993)
- 17) How to measure human function (Jul. 1993)
- 18) The amenity of office (Nov. 1993)
- 19) Human comfort and health in man-made environments-2 (Feb. 1994)
- 20) How to establish human comfort (June 1994)
- 21) How to measure human functions and utilize its result (Aug. 1994)
- 22) Logos and pathos in design action (Oct. 1994)

Table 3 Session of Physiological Anthropology in the 8th International Congress of Anthropological and Ethnological Sciences (Tokyo, 1968).

- Chairman:** Prof. Wilton M. Krogman(U.S.A.), Co-chairman: Prof. Masahiko Sato (Japan)
- Studay of growth stage by chemical structural analysis of triglyceride of adipose tissue in man^(*)
- Aspects correlatifs morph-fonctionnel et biochimiques de la croissance et du developpement des enfants et des adolescents
- Normal developement and adaptability of response in Japanese primary school children^(*)
- An anthropological study of high altitude adaptation in the Peruvian indians^(*)
- Chairman:** Prof. Paul T. Baker(U.S.A.), Co-chairman: Prof. Shiro. Kondo (Japan),
- Morph-fonctional population studies in some biogeochemical USSR provinces as viewed in the light of the adaptation problem
- Phylogenetic precursors of human sleep: an experimental analysis
- Activation level and cortical evoked responses^(*)
- The attitude of H-reflex to the repetitive stimulation and its meaning in human posture^(*)
- A study of human posture from viewpoints of cardiac cycles and relative metabolic rate^(*)
- A problem in the evaluation of fatigue by changes in the knee jerk^(*)
- Chairman:** Prof. James V. Neel(U.S.A.), Co-chairman: Prof. Isao Takahashi (Japan)
- An anthropological study of fatigue^(*)
- Measurement of the enduring capacity of the erectores supinae muscles and the electromyographic findings as related to their functions^(*)
- Fatiguability of human skeletal muscles^(*)
- Locomotion restraint as determinant of behavior
- Les aspects anthropogenetiques de la physiologie de l'activite nerveuse superieure et de la psychologie

(*) marks the paper presented by Japanese author(s)

Dr. T. Tokizane continued to lead this realm until his retirement from Tokyo University, though he became associate professor in 1954 and professor in 1956 in the field of medical physiology.

The development of physiological anthropology in Japan could be divided into three periods. The first period was characterized with human movement studies as the research focus. This period can be considered to continue until the late 1960s. When Dr. Tokizane began to lead this field, he was investigating neural and muscular mechanisms of human vocalization. For this reason, the problem concerning vocalization such as sex difference in vocalization became central theme in the early stage of the first period. Dr. Tokizane developed electromyographic method to study vocal muscles. He made the Reseach Society of Electromyography and the EMG became one of the most popular mothods in the field of physiological anthropology. Such various themes concerning human movements as muscular activities assuming a posture, skilled movements, muscle fatigue and functional differentiation of skeletal muscles were investigated with EMG technique in the field of physiological anthropology. Besides the EMG, the measurements of cardiac and respiratory cycles or energy metabolism gradually prevailed according to widening

Table 4 Symposium on "Human performances under environmental stress" at the 12th International Congress of Anthropological and Ethnological Sciences (Zagreb, 1988).

Thermal adaptability of the Japanese ^(*) (Prof. M. Sato)
Body movement during observation tasks(Prof. H. W. Jürgens)
Effects of ultra low cooling on skin temperature, forearm blood flow and EMG ^(*) (Prof. Y. Kikuchi)
Return to work after myocardial infarction(MI)(Dr. K. Undeutsch)
Effect of the head cooling on man under heat stress ^(*) (Dr. T. Katuura)
Effects of added resistive loads to inspiration on submaximal work load performance ^(*) (Dr. A. Yasukouchi)
Prediction of temperature heating rate during warm water immersion(Dr. I. B. Mekjavic)
Safety in the construction industry(Dr. M. Boudouxhe)
Household response to drought induced stress in western India(Dr. A. K. Gupta)
Chairpersons: Prof. Masahiko Sato(Japan)
Dr. Klaus Undeutsch(Germany)

^(*)marks the paper by Japanese author

of research theme in this realm.

In 1968, the 8th international congress of anthropological and ethnological sciences was held in Japan. Physiological anthropology settled its own session together with the other main fields. It was an epoch-making affair for physiological anthropology over the history of international congress of anthropological and ethnological sciences. The chairpersons and titles of papers of this session are shown in Table 3. They well reflected the characteristics and tendency of the first period of physiological anthropology in Japan. The chairpersons selected from Japan were a successor (Prof. I. Takahashi) and students (Prof. S. Kondo and Prof. M. Sato) of Prof. T. Tokizane. Most of the papers read in the session concerned with the movement studies as understood from their titles.

The time of the 8th international congress corresponded to the border between the first and second periods of physiological anthropology in Japan. The second period began in the late 1960s. The research theme of this field extended to various aspects of physiological resources of man. Human variation was investigated from viewpoints of the effects of nutrition, climate, modernization, and so on. Remarkable progresses were observed especially in the studies on environmental adaptability.

The biotrons such as climatron, hypo- or hyper-baric chambers, and acoustic chamber became effective facilities for the studies of environmental effects. For example, thermal adaptability was investigated by utilizing biotrons with various kinds of heat index consisting of sweat rate, heart rate, heat product, rectal temperature, or skin temperature. The lower and upper critical temperatures, the ratio of energy metabolism to skin temperature were frequently adopted as the criteria of thermal adaptability. Also, the quantitative analyses of hypo- and hyper-pressure effects on human activity were made. One of the greatest events of the 2nd period was the establishment of The Conversazione of Physiological Anthropology in 1978.

The characteristics of the 2nd period can be recognized also from the symposium of the 12th international congress of anthropological and ethnological sciences in 1988. Three symposia were settled for the field of physiological anthropology in Zagreb. The titles of them were "human performances under environmental stress", "effects of postural stress on man and productivity" and "anthropology and ergomechanism". Especially the first one, which was proposed from Japan, well reflected general tendency of physiological anthropology during second period. Almost all the foreign researchers listed in this table were the persons who had contacts with physiological anthropology in Japan and contributed to its progresses (Table 4).

The third period began at the late 1980s and is still progressing even now. In this period, the physiological anthropology in Japan developed to a science responsible for social needs, in the customary sense. Until the beginning of the 3rd period, physiological anthropology has accumulated the knowledge about man living in modern technological civilization. Man has changed the characteristics of his environment and the speed of this changing is being accelerated. Indeed, in the modern society, there is a growing concern that some kind of man-made environment would be potentially harmful to man. It may be a consensus of opinion that the urgent problem is to know what types of living environments or styles are optimal for human being. The present society needs a responsible human science for this problem. Thus, various kinds of social need have been surging up around this science.

The physiological anthropology in Japan started as a discipline-oriented science, and now seems to exist in the centre of social needs. Many of the members of Japan Society of Physiological Anthropology are working in the need-oriented field. As mentioned already (Table 2), the society has been holding seminars by the members to answer the social needs exemplified by such questions as "How much can people tolerate?" "What is optimal?" "What should we do?" from architects, industrial designers, urban planners, civil engineers, developers and the others.

Physiological anthropology is a science of man living on the earth whose culture is accelerating the tendency to technological civilization. This science is developing in two fields, theoretical or basic, and applied. "Applied Human Science-Journal of Physiological Anthropology", together with periodically holdings of the international congress of physiological anthropology, would be expected to contribute greatly to the progress of anthropology or science of man over the world.

Correspondence to: Masahiko Sato, Department of Physiological Anthropology, Kyushu University of Design Sciences, 4-9-1 Shiobaru, Minami-ku, Fukuoka 815, Japan