

LABORATORY MANUAL for BIOLOGICAL ANTHROPOLOGY



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Dedicated to the inspiring memory of our Teacher

Sasanka Sekhar Sarkar D.Sc., F.N.I.

PREFACE

Dr. S.S. Sarkar in 1957 attempted a small book titled, *Laboratory Manual of Somatology*. That was a pioneering attempt. Since then several authors have attempted in their own way to write treatise on Anthropometry, but none have attempted a comprehensive guide book on biological anthropology to satisfy the requirements of the undergraduate and postgraduate students. Our venture is precisely to serve that purpose for the benefits of the students as well as the teachers.

We never claim that we have been able to do justice to all the areas of biological anthropology covered in this book, but honestly we have tried to satisfy minimum needs of the undergraduate and postgraduate students of Indian universities.

We have consulted all the available books on the subject and also took necessary help from those.

We are thankful to all our students and colleagues who expressed their sincere interest in writing the treatise; we restrain our temptation to name them lest we cannot mention all of them. But we thankfully acknowledge the active involvement of Dr. Subha Ray of the Department of Anthropology, University of Calcutta, for his useful suggestion in preparing some of the topics.

We take this opportunity to convey our thanks to M/S Asian Books Enterprise for shouldering the responsibility of publication of the Manual.

We appeal to the students for whom this Manual is meant, and their teachers, for sending their suggestions for improvement of the Manual without any reservation.

We feel honoured to dedicate the book to the memory of our teacher, Dr. S.S.Sarkar, pioneer in this field in India.

01.05.08

D.M., D.P.M., P.B.

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INTRODUCTION

Blumenbaach's (1752-1840) attempt to classify human beings on the basis of shapes of *norma verticalis* of human cranium initiated the Classical Physical Anthropology for which he is regarded as the father of Physical Anthropology. As set by Blumenbaach, this branch devoted itself primarily in measuring human body dimensions and observing morphological features, only to apply those in classifying humans into typological races, with a positive bias of racial hierarchy.

Since 1900, with the advent of mutational hypotheses by de Vries, Tschermack and Correns and consequent rediscovery of Mendel's meticulous work on pea-plants, and also the discovery of blood antigens by Karl Landsteiner, the science of genetics was in the offing. This stimulus initiated genetic researches in all the fields of biology, including Physical Anthropology, which also contributed to the proliferation of Statistics, a tool for drawing facts from figures.

By 1950s works on physical anthropology reached such a ramification that it became urgent to redefine its scope, and this was aptly stated by Washburn (1957) in his article, "*The New Physical Anthropology*" to distinguish it from Classical Physical Anthropology. Since 1960s Physical Anthropology began expanding in multifarious dimensions. The discovery of the structure of DNA molecule and its activities added a novel dimension in the field of human genetics. As the application of DNA techniques has helped in understanding the proximity of our relationship with the apes, the techniques could also be successfully utilised in forensic investigations. Present researches attempt to construct a total mapping of human genes with a major emphasis on genetic therapy of inherited disorders, under Human Genome Programme.

Biological anthropology today studies human biological variation in time and space, as also at individual level; and attempts to apply the gathered knowledge in human welfare directly or indirectly.

The time dimension of human variation involves chiefly in understanding human evolution, which is basically a comparative understanding of different transitional forms between ancestral hominoids on the one hand, and modern humans, on the other. In these exercises a sound knowledge of human anatomy, often in comparison with other primates, especially the higher apes, are primarily required. This covers the areas of **Osteology**, **Comparative anatomy** and **Palaeoanthropology**.

Osteology embraces the morphological and metrical study of human bones as parts of human skeleton. It has two major subfields such as, **Craniology** and **Postcranial Osteology**. The metrical studies are accordingly designated as **Craniometry** and **Osteometry**.

Comparative anatomy deals with comparison of skeletal features between modern humans and other members of the order Primates, especially with the apes with whom modern humans show closest resemblance since they had branched off from the common ancestral Hominoid stalk in the course of primate evolution. Such comparative knowledge helps in comprehending the fossil evidence of human evolution.

Palaeoanthropology is concerned with the study of fossil evidences of human evolution from the primate stalk. This gives an understanding of shaping up of modern humans from nonhuman primate ancestors through passage of time; and the correspondence between biology and culture in this particular course of evolution.

The space dimension of human variation is concerned about variation of different geographical groups of humans, which purports to understand human physical adaptation in diverse geographical conditions. Such variations are mostly related with morphological characters (such as skin pigmentation,

hair form, features of nose, eye, lips etc.), metric characters (such as height, weight and other body dimensions, amount and distribution of body fat etc.) These studies cover the methodology of studying variations at individual level and are compounded at population level by drawing averages, designated as **Somatology**. The metric study of human body is known as **Somatometry**, a branch of Anthropometry; while the morphological study embraces the field of **Somatoscopy**. A special branch of somatology, **Somatotyping**, initially engineered by Sheldon and later developed by Heath and Carter, attempts to categorise individuals on the basis of relative proportions of adiposity, musculature and skeletal structure. This special branch helps in understanding variation in human physique.

Genetic variations between individuals are studied with the help of different known genetic traits, such as blood groups (ABO and Rh), PTC taste ability and sensitivity, Colour vision deficiency, Dermatoglyphics and many other genetic markers. Tests of these genetic traits help determination of identity of an individual as well as construction of gene pools at population level.

Broadly speaking, the methodology of Classical Physical anthropology rests on systematic measurement of human skeletal parts and on parts of human body (living or dead), designated as **Anthropometry**, observation of morphological features of the body (**Somatoscopy**), and also of cranium (**Craniology**) and Post-cranial skeletal parts (**Osteology**), and biochemical methods used in serology, including gel electrophoresis. In recent years, with the development of Biochemical and Molecular genetics, gene sequencing and amino acid sequencing, utilising Polymerase Chain Reaction (PCR), are being applied in specific fields of investigation.

Scheme of the present book: The present book has been designed to describe the methodologies of different branches of Biological Anthropology as required to train the undergraduate and post-graduate students of Anthropology, The book has been divided into seven sections (A – G).

Section–A, Osteology has been dealt with morphological and metrical studies of human skeleton and parts of it. The morphological study has been considered under two broad heads, dealt in two separate chapters viz. Craniology and Postcranial Osteology, and the methodology of metrical study of human bones has similarly been treated in two separate chapters, Craniometry and Osteometry, involving techniques of measurements on human cranium and those on long bones and bones of pectoral and pelvic girdles, respectively.

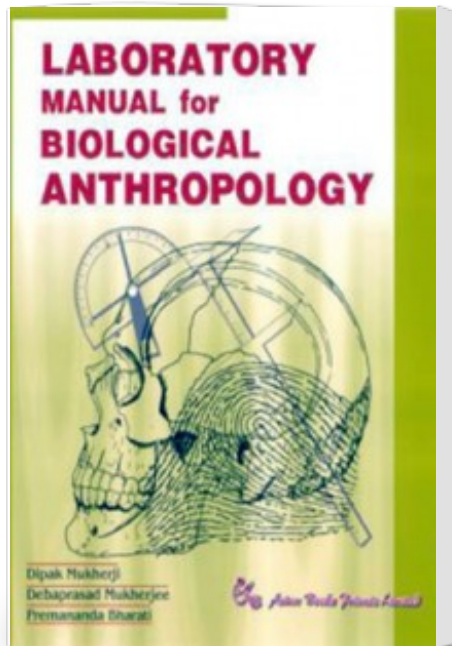
Section—B has been devoted to the methodology of **Comparative anatomy**, which is covered in one chapter of the same name. Most of the comparisons of anatomy have been done in relation to Gorilla and Chimpanzee, although a general comparative account of external morphological and skeletal features between humans and apes, and individual accounts of the four apes have been provided.

Section–C has been dealt with **Palaeoanthropology**, which has considered the fossil evidences of the main stages of human evolution from the points of their discovery, assessment of anatomical characters and position in Hominid phylogeny.

Section–D is devoted to the methodologies of **Somatology**, the science of human body. This has been dealt with in three chapters viz., **Somatoscopy**, **Somatometry** and **Somatotyping**. Somatoscopy deals with the methodology of phenotypic characters of human body, while Somatometry is concerned with the systematic measurement of physical dimensions. Somatotyping discusses the methodology of systematic categorisation of human physique on the basis of three components such as endomorphy (fat content), mesomorphy (musculature) and ectomorphy (skeletal structure).

Section–E has been devoted to the **Methodologies of some genetic traits**, where the methodologies of ABO and Rh blood grouping, Dermatoglyphics, PTC taste ability and sensitivity and Colour vision deficiencies have been described in a single chapter.

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Biological Anthropology Laboratories. Dr. Gary Aronsen, Manager. Yale Mammalian Evolutionary Morphology Laboratory. Professor Eric Sargis, PI. Yale Reproductive Ecology Laboratory. Professors Richard Bribiescas and Claudia Valeggia, PIs. Established in 1998, biological anthropologists at the Yale Reproductive Ecology Laboratory conduct research on the evolutionary biology of humans and non-human primates. We are particularly interested in the evolutionary biology of key life history traits such as reproduction, growth, aging, and immune function. The #1 manual for biological anthropology, Soluri/Agarwal has become even more visual and hands-on in its Second Edition. New interactive exercises that emphasize the process of science and the scientific method, along with increased and improved images in the osteology chapters, give students the most impactful lab experience. And whether used standalone or packaged with The #1 manual for biological anthropology, Soluri/Agarwal has become even more visual and hands-on in its Second Edition. Be the first to ask a question about Laboratory Manual and Workbook for Biological Anthropology. Lists with This Book. This book is not yet featured on Listopia. Biological anthropology, also known as physical anthropology, is a scientific discipline concerned with the biological and behavioral aspects of human beings, their extinct hominin ancestors, and related non-human primates, particularly from an evolutionary perspective. This subfield of anthropology systematically studies human beings from a biological perspective.