

# *Surgery of the* **LARYNX**

BYRON J. BAILEY, M.D.

HUGH F. BILLER, M.D.

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1 St. Anne's Road  
Eastbourne, East Sussex BN21 3UN, England

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9 Waltham Street  
Artarmon, N.S.W. 2064, Australia

Ichibancho, Central Bldg., 22-1 Ichibancho  
Chiyoda-Ku, Tokyo 102, Japan

### **Library of Congress Cataloging in Publication Data**

Main entry under title:

Surgery of the larynx.

1. Larynx—Surgery. I. Bailey, Byron J. II. Biller,  
Hugh F. [DNLM: 1. Larynx—Surgery.  
WV 540 S9606]

RF516.S9 1985 617'.533 83-20415

ISBN 0-7216-1472-8

Surgery of the Larynx

ISBN 0-7216-1472-8

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Last digit is the print number: 9 8 7 6 5 4 3 2 1

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# PREFACE

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*"If you wou'd not be forgotten  
As soon as you are dead and rotten,  
Either write things worth reading,  
Or do things worth the writing."*

BENJAMIN FRANKLIN (1706–1790)  
Poor Richard's Almanack, 1738

Simply put, Hugh Biller and I have tried to generate a book written primarily for and by laryngeal surgeons.

It is our objective to provide the best current views concerning the evaluation and management of laryngeal disorders and neoplasms. We have endeavored to present a broad perspective of the rationale underlying the various forms of therapeutic intervention that are reviewed. Unlike a surgical atlas, this book emphasizes the important, new, scientific information that documents the effectiveness of specific techniques by long-term follow-up of patients.

We have tried to collect between these two covers all that you ever wanted to know about laryngeal surgery, and more.

The Editor and Co-Editor are deeply indebted to a great many individuals who have been patient, tolerant, and hard-working over the past several years. Through their efforts, the vision has now become a reality, and we offer special thanks—

- To our wives, Margi and Dianne, who sustain us;
- To our teachers, Joel J. Pressman, M.D., and Joseph H. Ogura, M.D., who provided the core inspiration;
- To our numerous, treasured professional colleagues who provided the priceless ingredients—the chapters;
- To our medical institutions, the University of Texas Medical Branch at Galveston and the Mount Sinai Medical School, New York City, who were tolerant over the past years of the time and expense invested in preparation of this volume;
- To our illustrator, Tony Pazos, and our manuscript typists, Marilyn Hall, Carol Grunden, and Connie Smith, for working their fingers "to the bone";
- To Lisette Bralow, our Editor at Saunders, for her patience and encouragement;
- And most especially, to Lynn Alperin, our relentless, perfectionistic project foreman and medical editor, without whose dogged persistence there would be no book.

Finally, we wish to acknowledge the generous support that has been provided by the H. C. Wiess family of Houston and the James A. Sartain family of Newton, Texas. Their philanthropy has been invaluable in the achievement of this project.

We hope the information contained in these pages will provide the answers to the questions raised by the disease states we find in our patients. Any value in this regard will be ample reward for the time that all of us have spent.

BYRON J. BAILEY, M.D.

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PART

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# INTRODUCTION TO SURGERY OF THE LARYNX



# Developmental Anatomy of the Larynx

John A. Tucker, M.D.

The first portion of the human respiratory tree to be studied from the viewpoint of development was the larynx. Although Fleischman<sup>1</sup> reported such studies in 1820, the larynx was not described in a closely graded series of specifically staged human embryos until 1972.<sup>2</sup> Common practice has arranged individual human embryos in order of either supposed age or size. Both criteria are unsatisfactory, first, because we cannot determine the precise age of an embryo and, second, because size at any given age varies. Moreover, arrangement by age does not necessarily coincide with morphologic development because some individuals grow more rapidly than others, both prenatally and postnatally. Longer embryos, like taller people, are not necessarily more developed than shorter ones.<sup>3</sup> Also, fixation and shrinkage affect embryonic length.

Embryos are best arranged in stages, with these stages designating developmental levels and marking the appearance of specific morphologic features such as eyes and limb buds. Because embryonic length is merely one index of development and does not, in itself, constitute a stage, expressions such as "a 15-mm stage" should be discarded.<sup>3</sup>

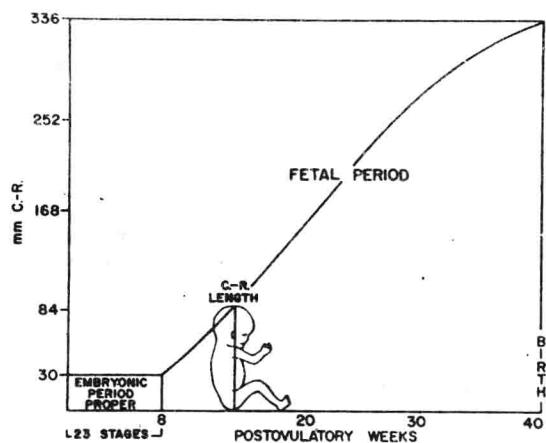
## THE CARNEGIE SYSTEM

Dr. Franklin P. Mall, first director of the Department of Embryology of the Carnegie Institution of Washington, Washington, DC, originated the practice of staging the human embryo. In 1887, as a medical student at Johns Hopkins University, Dr. Mall acquired the first of what was to become the most important collection of human embryos in the world—the Carnegie Collection. Subsequently, he continued to enlarge his personal collection of human embryos. In 1914, Dr. Mall suggested that the Carnegie Institution of Washington establish the Department of Embryology. The Carnegie Institution did so and named Dr. Mall its first director. Also in that year, Dr. Mall described human embryonic development by stages.

Dr. George L. Streeter, who succeeded Dr. Mall, outlined the present 23-stage Carnegie System in 1942. Realizing that better specimens of the earlier stages would become available as techniques improved, Dr. Streeter concentrated on describing Stages 10 to 23. Since then, Dr. Ronan O'Rahilly has further described Stages 1 to 9 and refined Stages 10 to 23.<sup>4</sup>

The embryonic period proper—the first eight





**Figure 1-1.** The embryonic period proper, the first 8 postovulatory weeks of development, is shown in relation to the fetal period. Fetuses, as well as older embryos, are measured by their crown-rump length, which corresponds to the sitting height postnatally. (From Tucker JA, Tucker GF Jr: *Ann Otol Rhinol Laryngol* 84:51, 1975.)

postovulatory weeks of development—is contrasted to the fetal period—the last seven months of human development (Fig. 1-1). Fetuses and older embryos are measured by their crown-rump length, which corresponds to the postnatal sitting height.

## STAGING OF THE HUMAN EMBRYO

(Table 1-1)

These observations are based on 40 staged and sectioned human embryos in the Carnegie Collection.<sup>3</sup>

### Stages 1 to 8—About 19 Days; Length to About 1.4 mm; 0 Pairs of Somites

Staging is based on morphologic appearance of the embryo or its chorion. No sign of the foregut is seen in the early stages, and hence no indication of the respiratory system.

### Stage 9—About 20 Days; 1.5 to 2.5 mm; 1 to 3 Pairs of Somites

The first indications of the foregut and of the median pharyngeal groove presaging the respiratory system (including the larynx) are noted at Stage 9 (Fig. 1-2).

### Stage 10—About 22 Days; 2 to 3.5 mm; 4 to 12 Pairs of Somites

The neural folds begin to fuse. The respiratory and hepatic primordia appear; the laryngotracheal sulcus is identifiable at the caudal expan-

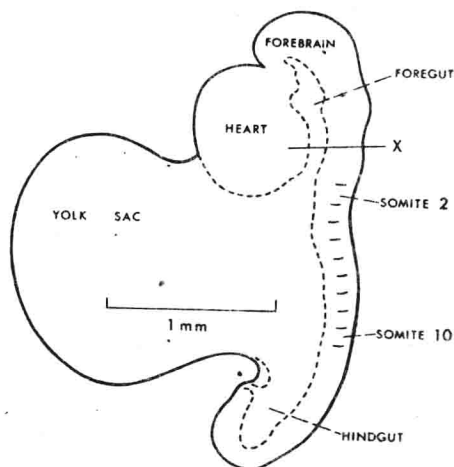


**Figure 1-2.** Section through the pharynx and heart of a human embryo of Stage 9 (3 weeks), 1.38 mm in length. The median pharyngeal groove can be seen immediately dorsal to the heart. In the heart, the so-called epimyocardial mantle, the cardiac mesenchyme ("jelly"), and the endocardium can be identified. (From O'Rahilly R, Tucker JA: *Ann Otol Rhinol Laryngol* 82(Suppl 7):14, 1973.)

sion of the median pharyngeal groove (Figs. 1-3 and 1-4).

### Stage 11—About 24 Days; 2.4 to 4.5 mm; 13 to 20 Pairs of Somites

The rostral neuropore closes. The respiratory system, including pulmonary primordium, divides into right and left lobes (Fig. 1-5).



**Figure 1-3.** Left lateral view of a human embryo of 3 weeks (Stage 10), 3.3 mm in greatest length and possessing 10 pairs of somites. Interrupted line indicates the gut; X, the plane of section of the photomicrograph shown in Figure 1-4. (From Tucker JA, O'Rahilly R: *Ann Otol Rhinol Laryngol* 81:521, 1972.)