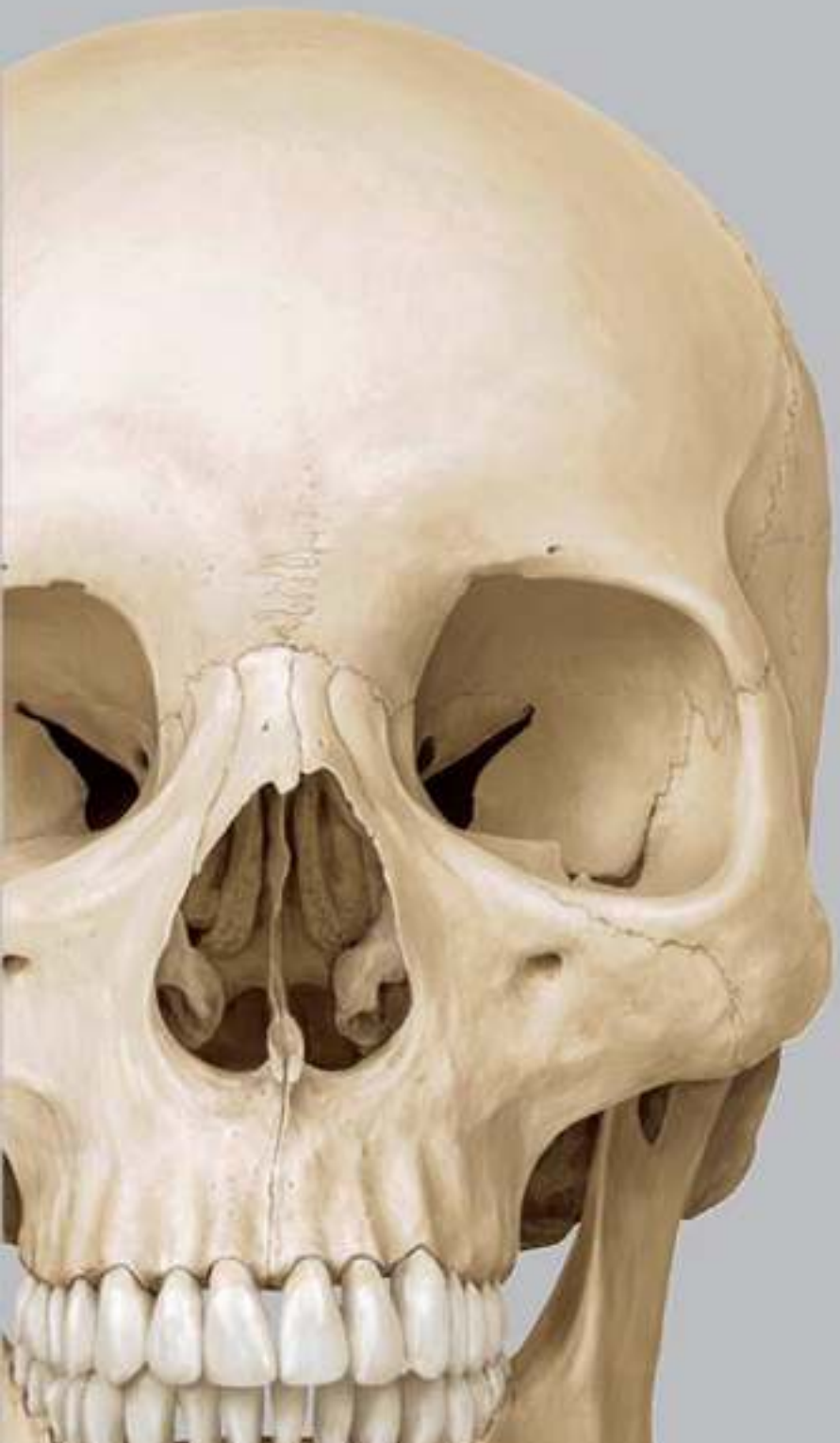
THIEME
Atlas of Anatomy

Head and Neuroanatomy

Michael Schuenke
Erik Schulte
Udo Schumacher

Consulting Editors
Lawrence M. Ross
Edward D. Lamper
Ethan Taub

Illustrations by
Markus Voll
Karl Wesker



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1182 Illustrations
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Foreword

Our enthusiasm for the THIEME Atlas of Anatomy began when each of us, independently, saw preliminary material from this Atlas. We were immediately captivated by the new approach, the conceptual organization, and by the stunning quality and detail of the images of the Atlas. We were delighted when the editors at Thieme offered us the oppertunity to cooperate with them in making this outstanding resource available to our students and colleagues in North America.

As consulting editors we were asked to review, for accuracy, the English edition of the THIEME Atlas of Anatomy. Our work involved a conversion of nomenclature to terms in common usage and some organizational changes to reflect pedagogical approaches in anatomy programs in North America. In all of this, we have tried diligently to remain faithful to the intentions and insights of the original authors.

We would like to thank the team at Thieme Medical Publishers who worked with us. Heartfelt thanks go firtst to Kelly Wright, Developmental Editor, and Cathrin E. Schulz, M.D., Executive Editor, for her assistance and checking and correcting our work and for their constant encouragement and availability. We are also grateful to Bridget Queenan, Developmental Editor, who provided a uniquely thorough, thoughtful, and cooperative approach from the moment she entered the process in the editing of this volume.

We would also like to extend our heartfelt thanks to Stefanie Langner, Production Manager, for preparing this volume with care and speed.

Lawrence M. Ross,
Edward D. Lamperti
Ethan Taub

Preface

As it started planning this Atlas, the publisher sought out the opinions and needs of students and lecturers in both the United States and Europe. The goal was to find out what the “ideal” atlas of anatomy should be—ideal for students wanting to learn from the atlas, master the extensive amounts of information while on a busy class schedule and, in the process, acquire sound, up-to-date knowledge. The result of this work is this Atlas. The THIEME Atlas of Anatomy, unlike most other atlases, is a comprehensive educational tool that combines illustrations with explanatory text and summarizing tables, introducing clinical applications throughout, and presenting anatomical concepts in a step-by-step sequence that allows for the integration of both system-by-system and topographical views.

Since the THIEME Atlas of Anatomy is based on a fresh approach to the underlying subject matter itself, it was necessary to create for it an entirely new set of illustrations—a task that took eight years. Our goal was to provide illustrations that would compellingly demonstrate anatomical relations and concepts, revealing the underlying simplicity of the logic and order of human anatomy without sacrificing detail or aesthetics.

With the THIEME Atlas of Anatomy, it was our intention to create an atlas that would guide students in their initial study of anatomy, stimulate their enthusiasm for this intriguing and vitally important subject, and provide a reliable reference for experienced students and professionals alike.

“If you want to attain the possible, you must attempt the impossible” (Rabindranath Tagore).

Michael Schünke, Erik Schulte, Udo Schumacher,
Markus Voll, and Karl Wesker

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ect assistant, working “behind the scenes” on numerous tasks such as
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ists established conditions for a cooperative partnership.

Without exception, our collaboration with the entire staff at Thieme
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we do not have room to list everyone who helped in the publication o
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and promotion.

The Authors

To access additional material or resources available with this e-book, please visit http://www.thieme.com/bonuscontent. After completing a short form to verify your e-book purchase, you will be provided with the instructions and access codes necessary to retrieve any bonus content.

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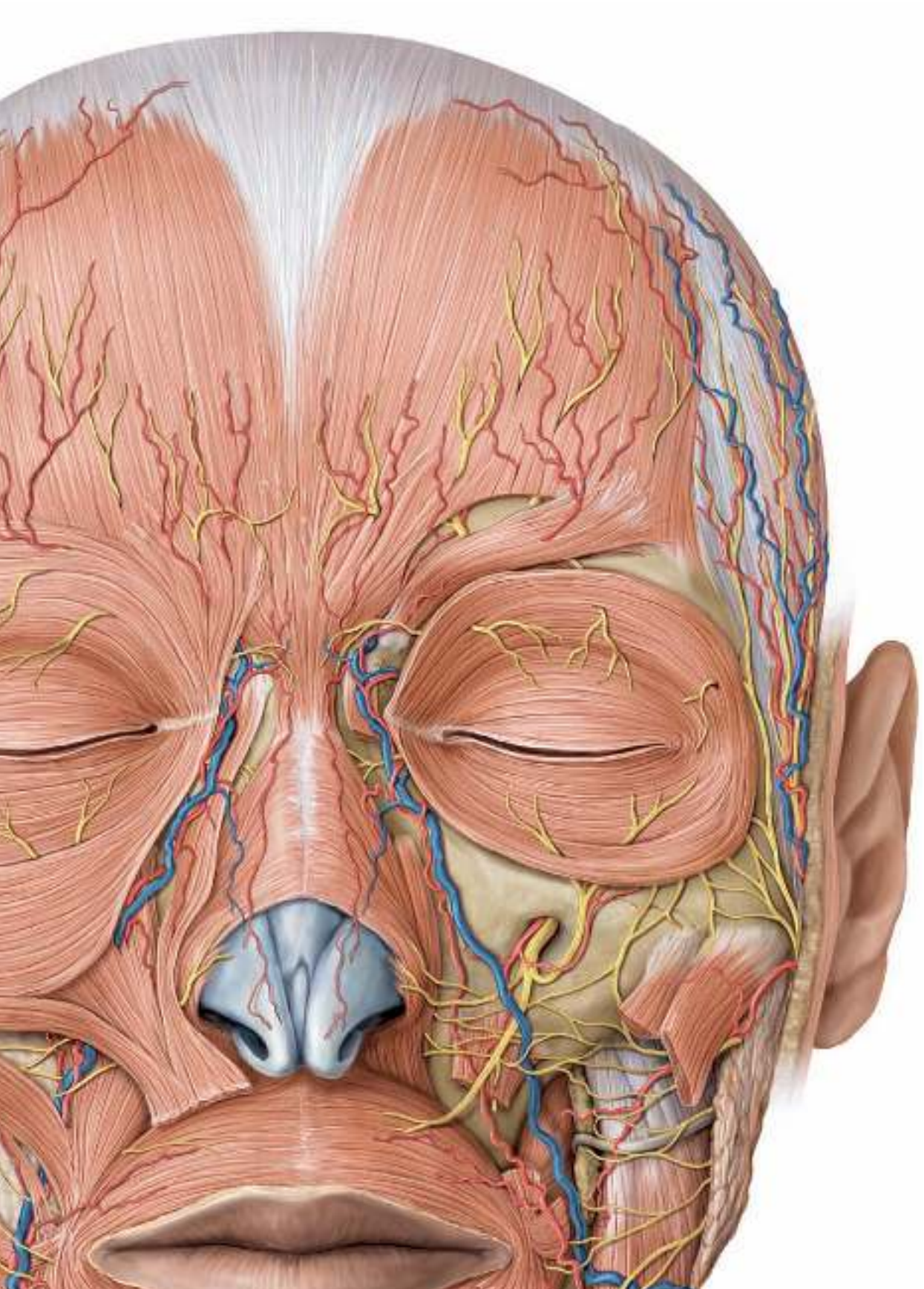


1.1 Skull, Lateral View

B Lateral view of the cranial bones
Left lateral view. The bones are shown in different colors to demonstrate more clearly their extents and boundaries.

C Bones of the neurocranium (gray) and viscerocranium (orange)
Left lateral view. The skull forms a bony capsule that encloses the brain, sensory organs, and viscera of the head. The greater size of the neurocranium (cranial vault) relative to the viscerocranium (facial skeleton) is a typical primate feature directly correlated with the larger primate brain.

D Ossification of the cranial bones
Left lateral view. The bones of the skull either develop directly from mesenchymal connective tissue (intramembranous ossification, gray) or form indirectly by the ossification of a cartilaginous model (enchondral ossification, blue). Elements derived from intramembranous and endochondral ossification (desmocranium, chondrocranium) may fuse together to form a single bone (e.g., the occipital bone, temporal bone, and sphenoid bone).
The clavicle is the only tubular bone that undergoes membranous ossification. This explains why congenital defects of *intramembranous* ossification affect both the skull and clavicle *(cleidocranial dysostosis)*.

E Bones of the neurocranium and viscerocranium

Neurocranium (gray)	**Viscerocranium** (orange)

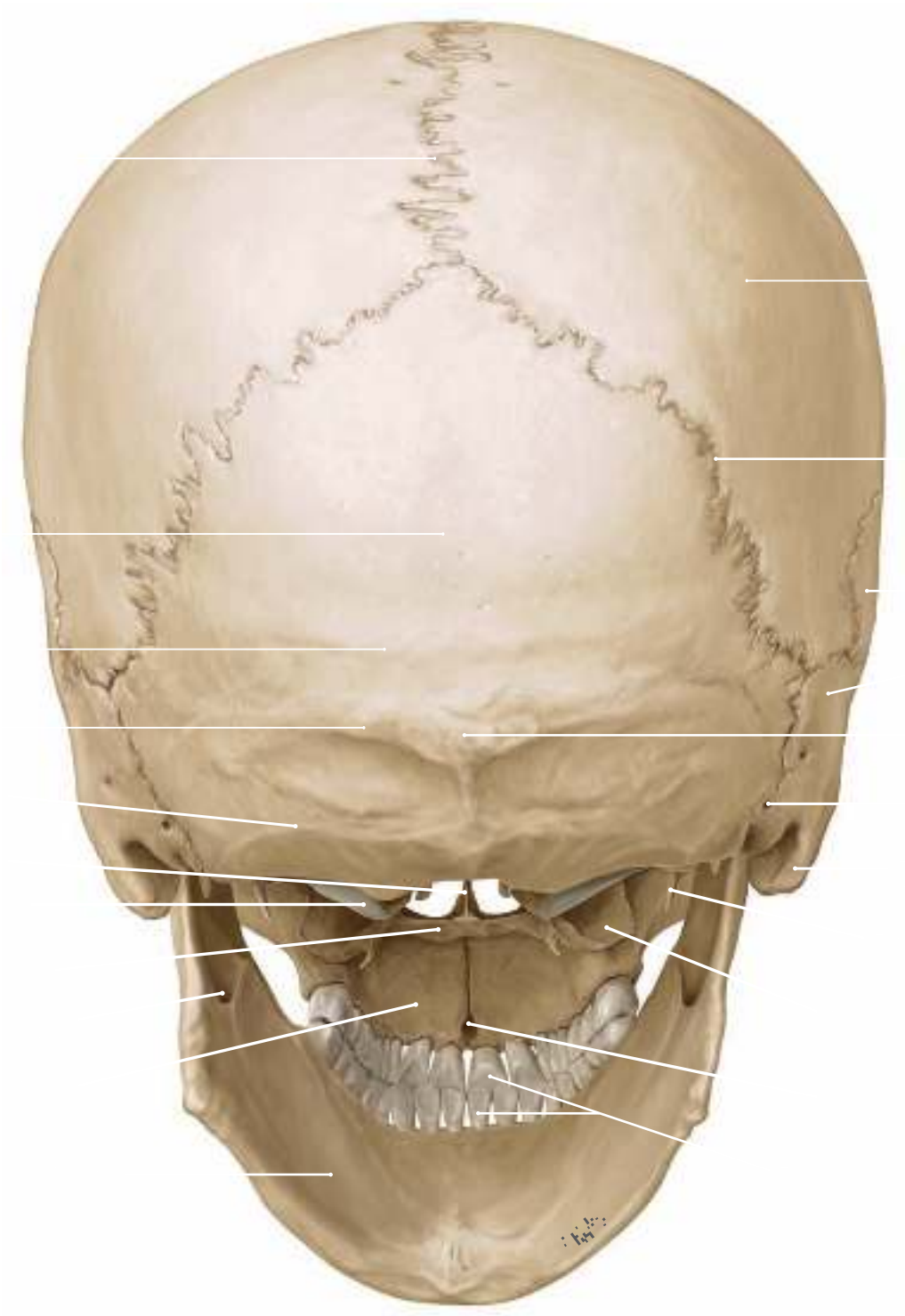
F Bones of the desmocranium and chondrocranium

Desmocranium (gray)	**Chondrocranium** (blue)

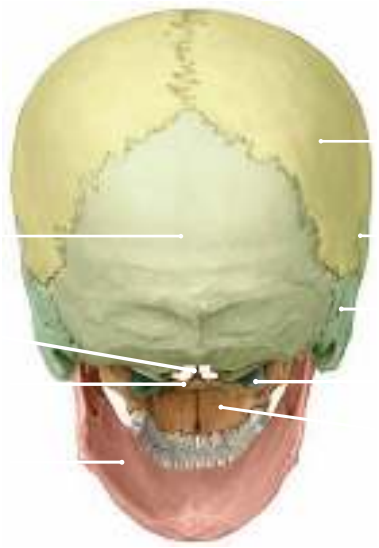
1.2 Skull, Anterior View

A Anterior view of the skull
The boundaries of the facial skeleton (viscerocranium) can be clearly appreciated in this view (the individual bones are shown in **B**). The bony margins of the anterior nasal aperture mark the start of the respiratory tract in the skull. The nasal cavity, like the orbits, contains a sensory organ (the olfactory mucosa). The *paranasal sinuses* are shown schematica in **C.** The anterior view of the skull also displays the three clinically i portant openings through which sensory nerves pass to supply the fa the supraorbital foramen, infraorbital foramen, and mental foram (see pp. 77 and 93).

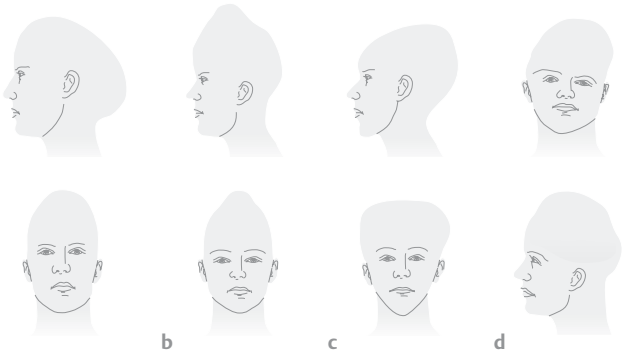
1.3 Skull, Posterior View and Cranial Sutures



A Posterior view of the skull
The occipital bone, which is dominant in this view, articulates with the parietal bones, to which it is connected by the lambdoid suture. The cranial sutures are a special type of syndesmosis (= ligamentous attachments that ossify with age, see **F**). The outer surface of the occipi bone is contoured by muscular origins and insertions: the inferior, s perior, and supreme nuchal lines.

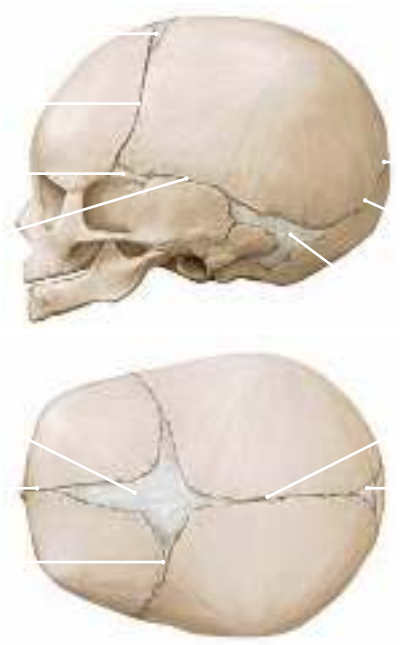


B Posterior view of the cranial bones
Note: The temporal bone consists of two main parts based on its embryonic development: a squamous part and a petrous part (see p. 22).



D Cranial deformities due to the premature closure of cranial sutures
The premature closure of a cranial suture (craniosynostosis) may lead to characteristic cranial deformities. The following sutures may close prematurely, resulting in various cranial shapes:

a Sagittal suture: scaphocephaly (long, narrow skull)
b Coronal suture: oxycephaly (pointed skull)
c Frontal suture: trigonocephaly (triangular skull)
d Asymmetrical suture closure, usually involving the coronal suture: plagiocephaly (asymmetrical skull)



C The neonatal skull
a Left lateral view, **b** superior view.
The flat cranial bones must grow as the brain expands, and so the sutures between them must remain open for some time (see **F**). In the neonate, there are areas between the still-growing cranial bones that are not occupied by bone: the fontanelles. They close at different times (the sphenoid fontanelle in about the 6th month of life, the mastoid fontanelle in the 18th month, the anterior fontanelle in the 36th month). The *posterior fontanelle* provides a reference point for describing the position of the fetal head during childbirth, and the *anterior fontanelle* provides a possible access site for drawing a cerebrospinal fluid sample in infants (e.g., in suspected meningitis).

E Hydrocephalus and microcephaly
a Characteristic cranial morphology in *hydrocephalus*. When the brain becomes dilated due to cerebrospinal fluid accumulation *before* the cranial sutures ossify (hydrocephalus, "water on the brain"), the neurocranium will expand while the facial skeleton remains unchanged.
b *Microcephaly* results from premature closure of the cranial sutures. It is characterized by a small neurocranium with relatively large orbits.

F Age at which the principal sutures ossify

Suture	Age at ossification

1.4 Exterior and Interior of the Calvaria