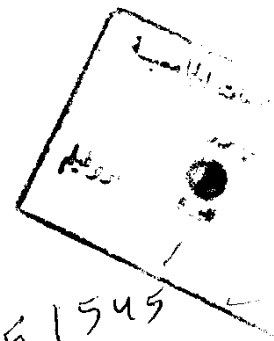
# Cerebral Disorders After Cardiopulmonary Bypass

An Essay Submitted for the Partial Fulfillment of the Master Degree in Anaesthesiology and I.C.U.

*By*

**Hatem Said Abdel-Hamid**
M.B., B.Ch.





*Supervised By*

**Prof. Dr. Salah Eldin Mostafa El-Halaby**
Professor of Anaesthesiology and I.C.U.
Faculty of Medicine-Ain Shams Univeristy

**Prof. Dr. Ahmed Gamal Eissa**
Professor of Anaesthesiology and I.C.U.
Faculty of Medicine-Ain Shams Univeristy

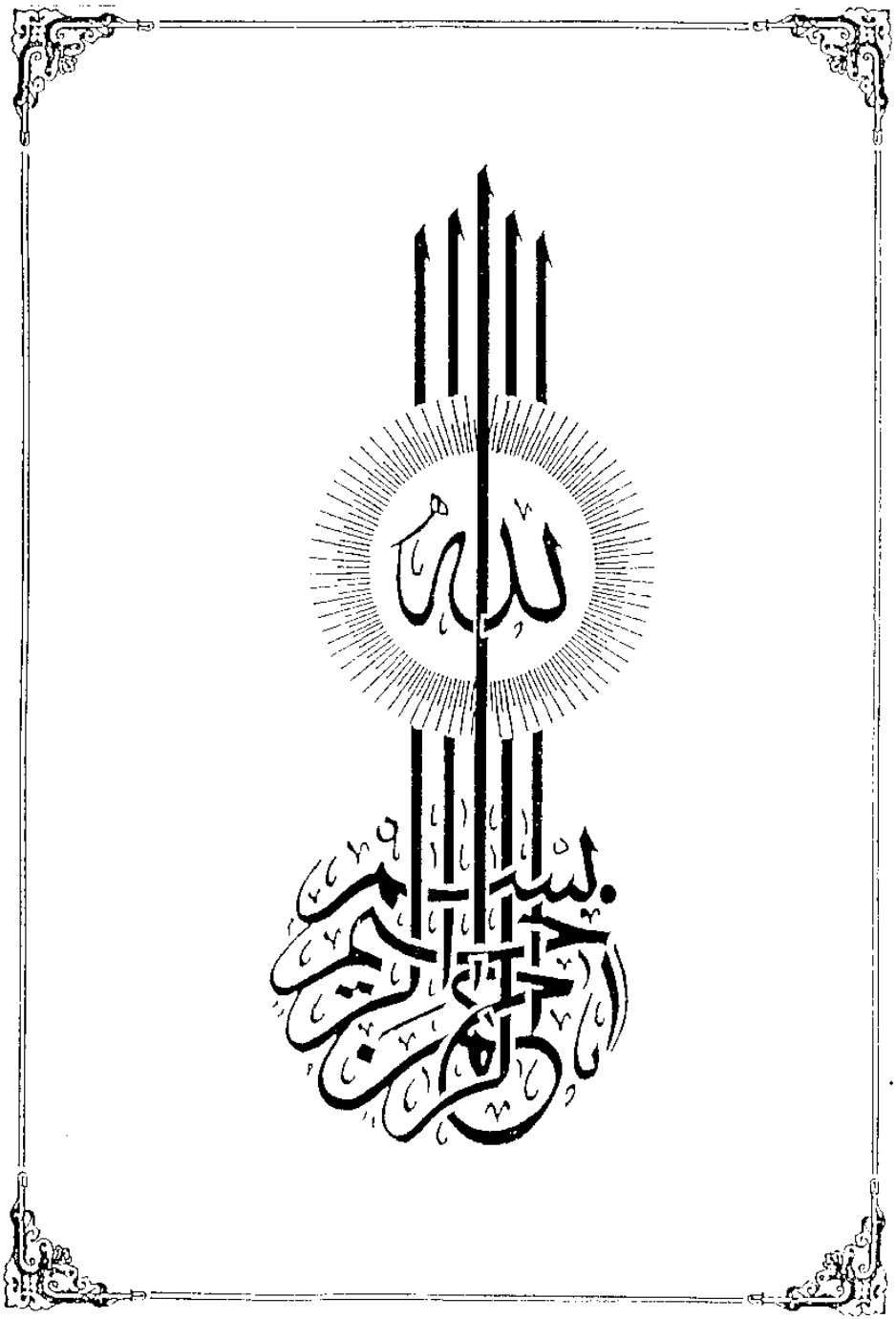
**Dr. Zakaria Abdel-Aziz Mostafa**
Lecturer of Anaesthesiology and I.C.U.
Faculty of Medicine-Ain Shams Univeristy

**Faculty of Medicine**
**Ain Shams University**
**1995**

بسم الله الرحمن الرحيم

# قالوا سبحانك لا علم لنا إلا ما علمتنا إنك أنت العليم الحكيم

صدق الله العظيم



*To My Family*

# *Acknowledgment*

*Firstly, thanks to* ***Allah***

***I*** *deeply express my utmost gratitude to* ***Prof. Dr. Salah El-Din Mostafa El-Halaby,*** *Professor of Anaesthesiology and I.C.U. Faculty of Medicine, Ain Shams University, for his great help, guidance and unlimited knowledge which have been of great value to complete this work.*

*My great thanks to* ***Prof. Dr. Ahmed Gamal Eissa*** *Professor of Anaesthesiology and I.C.U. Faculty of Medicine, Ain Shams University for his continuous support, advice and encouragement which enabled me to complete this work.*

*No words can express my gratitude and appreciation to* ***Dr. Zakaria Abdel-Aziz Mostafa,*** *Lecturer Anaesthesiology and I.C.U. Faculty of Medicine, Ain Shams University who saved no effort in helping and guiding me, without his help and guidance, this work could not be completed.*

***Lastly,*** *I would like to thank* ***all my Professors and Colleagues*** *in Department of Anaesthesiology, Faculty of Medicine, Ain Shams University for their continuous support and encouragement.*

*Hatem Said*

# List of contents

# *Anatomy of the Brain and its Circulation*

# Anatomy of the Brain and its Circulation

## The cerebral hemisphere:

The cerebral hemisphere forms the largest part of the brain, when viewed together from above, assume the outline of an ovoid mass broader behind than in front. The hemispheres are incompletely separated by a deep median cleft, named the longitudinal cerebral fissure and each possesses a central cavity, the lateral ventricle.

## The surfaces of the cerebrum:

Each cerebral hemisphere presents three surfaces:

1. Superolateral surface.
2. Medial surface.
3. Inferior surface.

The superolateral surface is convex in adaptation to the concavity of the corresponding half of the vault of the cranium. The medial surface is flat and vertical and is separated from that of the opposite hemisphere by the longitudinal fissure and falx cerebri. The inferior surface is often an irregular form, and may be divided into two parts, orbital and tentorial. The orbital part, being the orbital surface of the frontal lobes, is concave and rests on the orbital roofs and the nose, the tentorial part is concavoconvex; and is the inferior surface of the temporal and occipital lobes; anteriorly it is adapted to the corresponding half of the middle cranial fossa, posteriorly, it rests upon the tentorium cerebelli, which intervenes between it and the superior surface of the cerebellum.

The surfaces of the hemispheres are moulded into a number of irregular eminences, named gyri or convolutions, and separated by furrows termed sulci or fissures.

The irregular character of the surfaces of the cerebral hemispheres is a very prominent feature, but up to the end of third fetal month these surfaces are smooth and unbroken.

Each sulcus corresponds to an infolding of the cortex; therefore the total amount of grey matter is about three times as much as might be inferred from the surface area of hemisphere.

The gyri and their intervening sulci are fairly constant in arrangement, at the same time they vary within certain limits not only in different individuals but in the two hemispheres of the same brain.

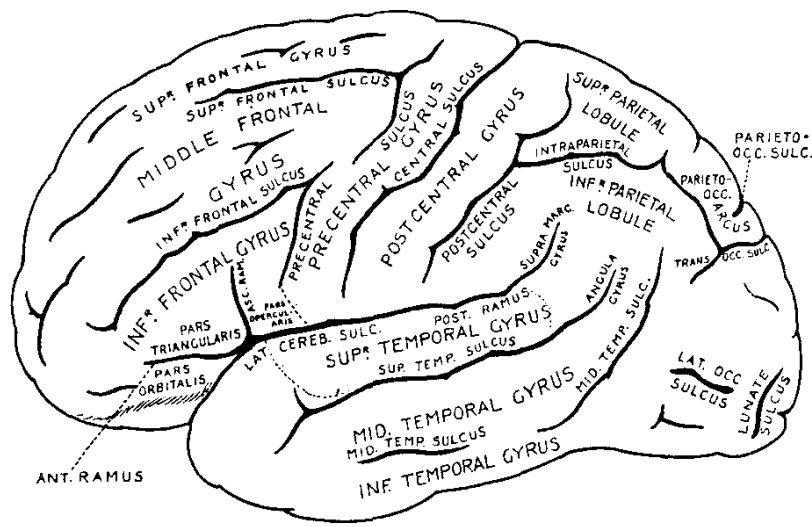
The actual area of the human cortex is about 3.200 $cm^2$ and only a third of this is visible on the surface, the rest being obscured from view in the sulci and fissures by this form of evolution a large increase in cortical area is possible without great change in cranial capacity.

## I. The superolateral surface of the cerebral hemisphere:

Two sulci, the lateral sulcus and the central sulcus take a large part in forming the boundaries of the lobes into which this surface is divided.

1. The frontal lobe.
2. The temporal lobe.
3. The parietal lobe.
4. The occipital lobe.
5. The insula.

CEREBRUM—SUPEROLATERAL SURFACE NEUROLOGY

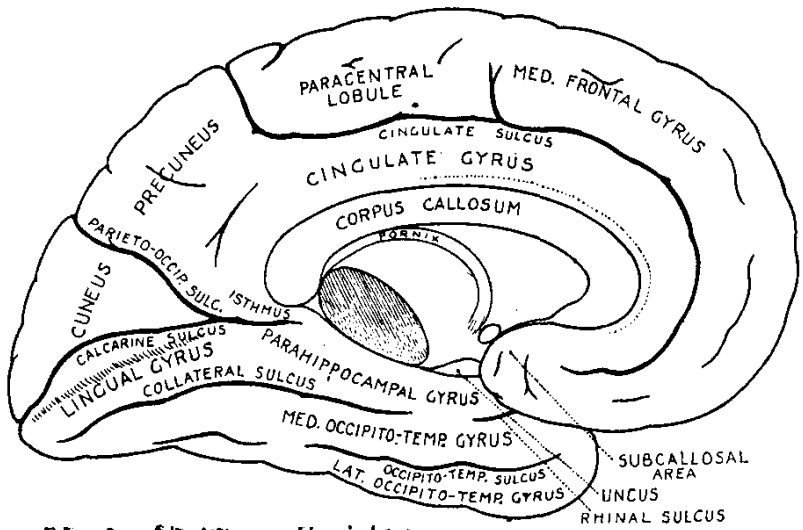



7.11 Lateral aspect of the superolateral surface of the left cerebral hem e.

## II. The medial surface of the cerebral hemisphere:

The most conspicuous feature of this surface is the greatest commissure which termed the corpus callosum.

CEREBRUM—MEDIAL SURFACE NEUROLOGY



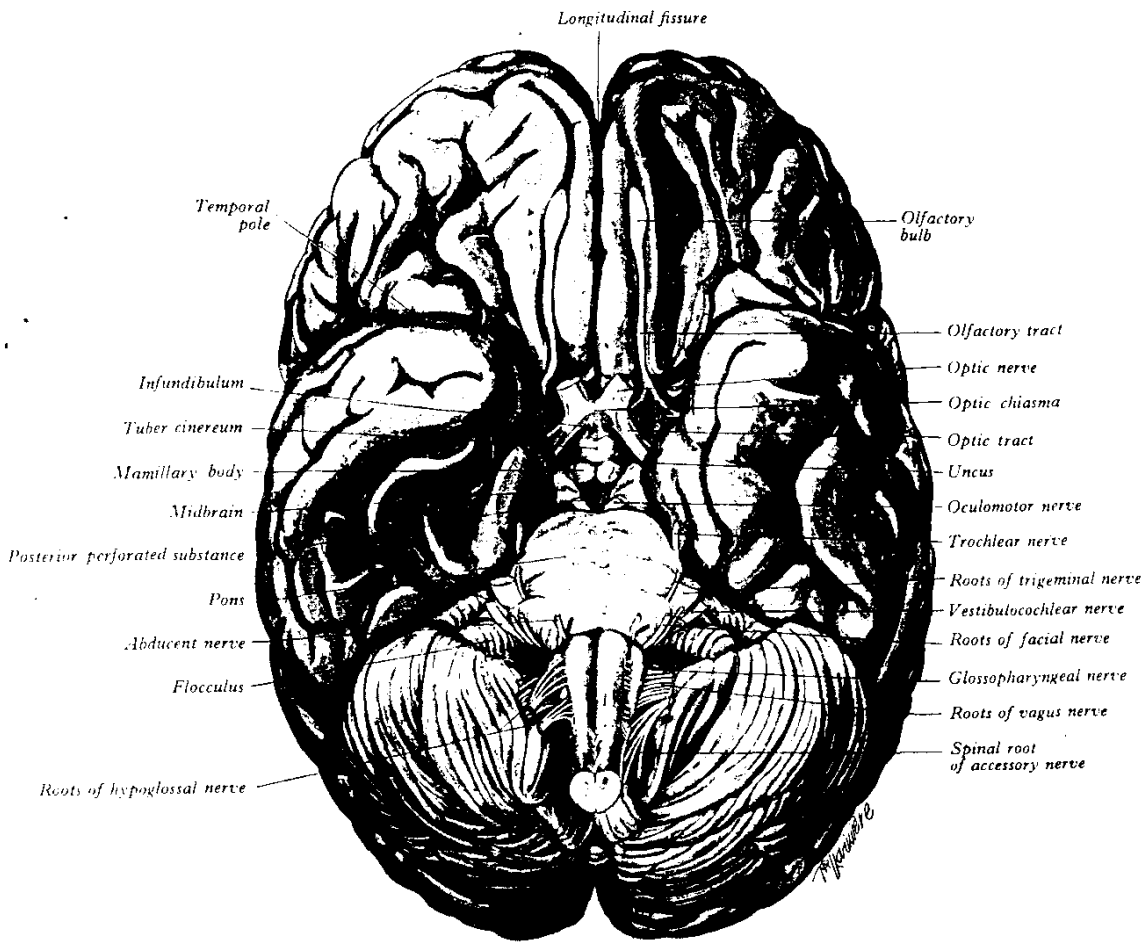

7.1144 Diagram of the medial surface of the left cerebral hemisphere after sagittal section of the brain, and removal of the brainstem.

## III. The inferior surface of the cerebral hemisphere:

This surface is divided into a small anterior region forming the orbital part and a larger posterior region forming the tentorial part.

1. Orbital part.
2. Tentorial part.






7.115A Basal aspect of the brain. The anterior perforated substance (unlabelled) is between the diverging lateral and medial roots of the olfactory tract and anterolateral to the optic tract.

## The cerebral cortex:

Quantitative studies of the cerebral cortex have been comparatively few, the total surface area is 220.000 $mm^2$ with a volume of 300 $cm^3$. Naturally the total number of cortical nerve cells has attracted much interest and computation about 14.000 millions.

## The main cortical areas:

### 1- The frontal lobe:

The frontal lobe may be divided into two main regions, precentral and the prefrontal. The former is largely sensorimotor, the latter "association cortex"

### I- The precentral area:

It has been divided into posterior and anterior parts, motor (area 4) and premotor (area 6), a feature of the whole precentral area is the prominence of pyramidal nerve cells of all sizes, the largest of these, the giant pyramidal cells of Betz.

This area is intimately involved in the mediation of voluntary movements. The order of loci starting from the paracentral lobule, is associated with the lower limb, the trunk, the upper limb and neck and head.

**- The primary, first somatomotor area "M.S.I.":**

Receives fibres from the cerebellum, which relay in the nucleus ventralis lateralis of the thalamus, and these are distributed particularly to its

anterior region "area 6" and to the prefrontal area "area 8". It also receives afferent concerned in other sensory modalities, probably via the thalamus, but in addition from the hypothalamus and other parts of the cortex.

The part of the precentral gyrus concerned with facial movements is the frontal eye field, it occupies a considerable part of the Brodmann "area 8", invading area 6 behind and probably "area 9" in front. Stimulation, elicit conjugate or binocular movements of the eyes, also movements of the head and pupillary dilation.

The motor speech area of Broca coinciding approximately with area 44 and a part of 45, also in the frontal lobe there is the supplementary motor area (M.S.II) and in parietal and temporal lobe the second motor speech area of Wernicke. All the three regions may be named the anterior, posterior and superior motor speech areas, develop in the dominant hemisphere in each individual.

**- The second somatosensory area (S.M.II):**

Movements of the most parts of the body can be elicited from it and the stimulation loci show a somatotropin organization.

## II- The prefrontal area:

Corresponds approximately to all parts of the frontal lobe which have not so far been particularized. It has abundant links with the thalamus, corpus striatum and hypothalamus, and it projects in addition to the