Sheep brain

The sheep brain lab corresponds closely to the information contained in the manual pp. 411-416. So today's procedure is to simply follow the procedure given in the lab manual. Each lab group will get two whole sheep brains, one to dissect but will remain a 'whole' brain, and other to be cut in half via a sagittal section. For dissection, what you will primarily use is a blunt probe - do not use a sharp probe because it damages the brain tissue. To dissect the whole brain, you will use a scalpel or scissors to cut away dura mater to see cranial nerves 1 through 6. Be careful, because pulling away dura mater tends to pull up cranial nerves along with it. After each terms below there is a w and/or s which indicates whether you will be responsible for that structure on a whole brain or sagittal section.

Terms for whole brain (w) and sagittal section (s)
3 cranial meninges w:
  - pia mater (vascular)
  - arachnoid (thin & web-like)
  - dura mater (tough, pinkish-white)
Gyrus, sulcus w
corpus callosum (labeled as splenium, trunk and genu fig. 30.3, 30.6) -function s
septum pellucidum s
lateral ventricle, 3rd ventricle, 4th ventricle s
choroid plexus of ventricles - function s
cerebr. spinal fluid
thalmus s (labeled 'intermediate mass in fig. 30.3)
pineal (epiphysis) s
pituitary (hypophysis) w,s (often not seen if dura mater is removed from brain)
infundibulum w
hypothalamus (mammillary body) w,s
optic chiasm w
cerebral peduncle w,s
superior colliculi w,s
inferior colliculi w,s
cerebellum - function w,s
pons w,s
medulla oblongata - function w,s
spinal cord w,s

Cranial nerves: w
olfactory (I)
optic (II)
occulomotor (III)
trochlear (IV)
trigeminal (V)
abducens (VI)
There are twelve cranial nerves in amniotes and they all have the same general functions (listed below). Cranial nerves are numbered I to XII from anterior to posterior and are traditionally designated with Roman numerals. Since cranial nerves are too small to be able to see well in dissection, you can learn their location by looking at a large plastic model (not as much fun, but it works...). We have a few human brain models that are good to use to see all cranial nerves. On the sheep brain, nerves I through VI are easy to distinguish but the other nerves are harder to see.

**Cranial nerves on human model**
(Responsible for number and name, function):

<table>
<thead>
<tr>
<th>Roman</th>
<th>Name</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>olfactory</td>
<td>smell (sensory)</td>
</tr>
<tr>
<td>II</td>
<td>optic</td>
<td>sight (sensory)</td>
</tr>
<tr>
<td>III</td>
<td>oculomotor</td>
<td>eye muscle (motor)</td>
</tr>
<tr>
<td>IV</td>
<td>trochlear</td>
<td>eye muscle (motor)</td>
</tr>
<tr>
<td>V</td>
<td>trigeminal</td>
<td>head, jaw (mixed)</td>
</tr>
<tr>
<td>VI</td>
<td>abducens</td>
<td>eye muscle (motor)</td>
</tr>
<tr>
<td>VII</td>
<td>facial</td>
<td>face (mixed)</td>
</tr>
<tr>
<td>VIII</td>
<td>auditory</td>
<td>sound (sensory)</td>
</tr>
<tr>
<td>IX</td>
<td>glossopharyngeal</td>
<td>tongue, pharynx (mixed)</td>
</tr>
<tr>
<td>X</td>
<td>vagus</td>
<td>to abdominal visera, pharynx (mixed)</td>
</tr>
<tr>
<td>XI</td>
<td>accessory</td>
<td>accessory to vagus, neck muscles (motor)</td>
</tr>
<tr>
<td>XII</td>
<td>hypoglossal</td>
<td>tongue muscle (motor)</td>
</tr>
</tbody>
</table>

The last nerve, hypoglossal, is left off of most these brain models. The pink brain model is best for nerves 9-12 (unfortunately we have only one).
Cerebrospinal fluid (CSF) is a clear, largely acellular fluid secreted by the choroid plexus (70%) and vessels of the ventricular walls into the lateral, third, and fourth ventricles. About 150 ml of CSF circulate through the ventricles and around the subarachnoid spaces (including cisterns). CSF flow through the central canal is minimal to non-existent. Although the fluid is an exudate of plasma from the capillaries (in the pia mater), it is significantly less density and protein than plasma. CSF drains into the subarachnoid space via median and lateral apertures (foramina of Magendie and Luschka, respectively) located in the fourth ventricle. Cisterns are dilated subarachnoid spaces formed at levels of the brain. The most notable of the cisterns are the lumbar cistern (not the central canal) in which the lumbar and lower nerve roots (cauda equina) float. This cistern is a frequent site of puncture (at a level of about the 4th lumbar vertebra) for withdrawal and diagnostic testing of CSF. Anesthetic agents and radiopaque dyes can also be introduced at this site. Cerebrospinal fluid is resorbed by cauliflower-shaped outpocketings of arachnoid villi. These villi project into the superior sagittal sinus, one of the large veins draining the brain.

CSF has a shock-absorbing function of great significance; the CNS literally floats within it. Cerebral injury from blows to the head are mitigated to a high degree by this fluid cushion. On the other hand, high intracerebral pressure induced by ventricular enlargement secondary to decreased CSF absorption or ventricular blockage (hydrocephalus) can cause significant brain damage.
PERIPHERAL NERVOUS SYSTEM
CRANIAL NERVES

CN: Use light colors throughout. (1) Beginning with the first cranial nerve, color the tile on the left; the large Roman numeral, the cranial nerve (CN), and the related function arrow at lower left; and the Roman numeral and accompanying illustration at upper right. The illustrations generally depict target organs/areas. (2) Note carefully the direction of the function arrows at lower left (sensory/afferent is incoming; motor/afferent is outgoing). (3) The accessory nerve (XI) has two roots: a spinal root and a cranial root that travels with the vagus nerve (X).

CRANIAL NERVES:
OLFACtory (I)
OPTIC (II)
OCULOMotor (III)
TROCHLEAR (IV)
TRIGEMINAL (V)
ABDUCENS (VI)
FACIAL (VII)
VESTIBULOCOCHLEAR (VIII)
GLOSSOPHARYNGEAL (IX)
VAGUS (X)
ACCESSORY (XI)
HYPOGLOSSAL (XII)

Cranial nerves I and II are derived from the forebrain; all others arise from the brain stem. V = visceral, referring to smooth muscle, glands, and organs with hollow cavities; S = somatic, referring to the skin, eye, skeletal, facial, and skeletal muscles; A = afferent or sensory; E = afferent or motor. All motor nerves depicted include proprioceptive fibers (sensory for muscle, tendon, and joint movement).

I VA: smell-sensitive (olfactory) receptors in roof/walls of nasal cavity.
II SA: light-sensitive (visual) receptors in the retina of the eye.
III SE: to extrinsic eye muscles (exc. lat. rectus and sup. oblique); VE: parasympathetic to ciliary and pupillary sphincter (eye) muscles via ciliary ganglion in the orbit.
IV SE: to superior oblique muscle of the eye.
V SA: from face via three divisions indicated; VE: to muscles of mastication, tensor tympani, tensor veli palatini, mylohyoid, and digastric muscles.
VI SE: to lateral rectus muscle of the eye.
VII VA: from taste receptors anterior tongue; SA: from ext. ear; VE parasympathetic to glands of nasal/oral cavity, lacrimal gland (via pterygopalatine ganglion in fossa of same name), submandibular/sublingual salivary glands (via submandibular ganglion in region of same name); VE: to facial muscles, stapedius (mid. ear), stylohyoid, post. digastric muscles.
VIII SA: cochlear part is sound-sensitive; vestibular part is sensitive to head balance and movement (equilibrium).
IX VA: from taste receptors posterior one-third tongue; SA: from ext. ear and ext. auditory canal; VA: from mucous membranes of posterior mouth, pharynx, auditory tube, and middle ear; from pressure and chemical receptors in carotid body and common carotid artery; VE: to sup. constrictor m. of the pharynx, stylopharyngeus; VE parasymp. to parotid gland (via otic ganglion in infratemporal fossa).
X VA: from taste receptors at base of tongue and epiglottis; SA: from ext. ear and ext. auditory canal; VA: from pharynx, larynx, thoracic and abdominal viscera; VE: to muscles of palate, pharynx, and larynx; VE parasymp. to muscles of thoracic and abdominal viscera (via intramural ganglia).
XI Cranial root: joins vagus (VA to laryngeal muscles); spinal root (C1-C5): innervates trapezius and sternocleidomastoid muscles.
XII SE: to extrinsic and intrinsic muscles of tongue.