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Short Notes on a
course of
Practical Physiology

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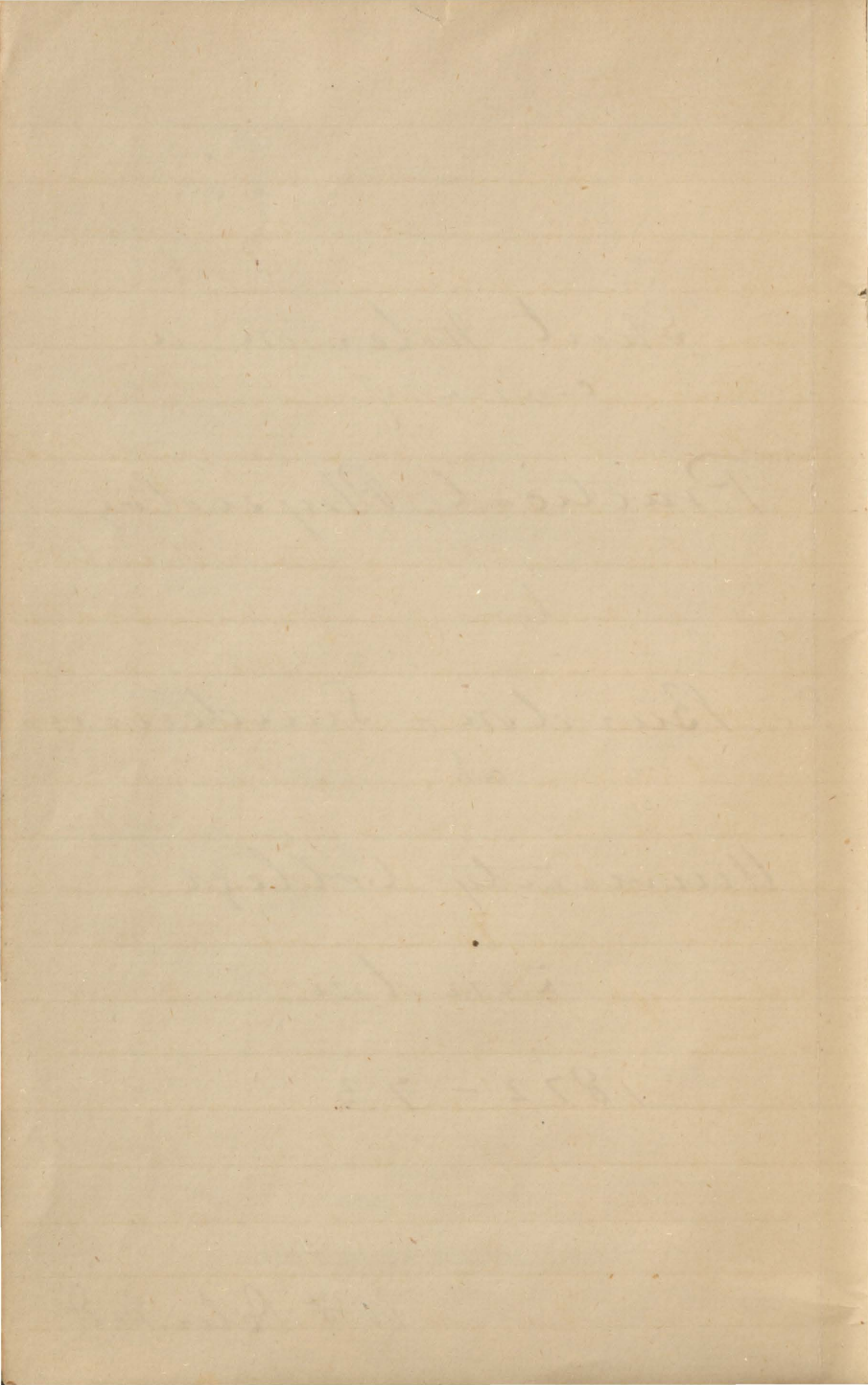
Dr. Burdon-Sauderson
at

University College

London

1872 - 73

Wm. Osler. M.D.



Oct 7th

Examination of inflamed anterior chamber of eye of frog and of lymph sac. They were prepared in the following way. A thread was passed into the anterior chamber & through the cornea, one end then cut short & pulled in tight, the other like wire. A portion of frog skin soaked in ammonia was then inserted into the lymph sac over the cervical region & pushed down towards the lumbar & there left. The animal is ready for examination in two days. To remove the pus from eye, prick it with a Δ knife & then quickly insert a capillary pipette. Numerous pus globules are found, all of them exhibiting very active movements, changing shapes rapidly, containing granules, vacuoles & a nucleus

apparently

The cornea is not much altered but when examined, the junctions between the epithelial layers are found wavy & exhibiting movement. Treat the lymph sac in following way. Dissect carefully off a thin layer, taking care not to touch the endothelium (it is best done under water) and brush it with a solution of $AgNO_3$ $1/4\%$, then place it in the sun light for a short time, on examination it will be found that the outlines of the cells are stained & pus globules are coloured.

10th Examination of omentum of rabbit 3 days after injection with animalized milk. After being brushed with solution of $AgNO_3$ & exposed to light; cut square pieces & examine, floating them on to the glass slips & labelling & neat care to obtain the specimen free from

fold & creases. The serous epithelium
is seen mapped out by the agno₃,
the cells containing many minute
particles looking like fine oil glob-
ules, but may ~~be~~ ^{be} the deposit of agcl
in them. Vessels of these kind are
seen veins, arteries & lymphatics
the latter being the interesting ones.
They seem to be found more in the
track of the vessels than in the inter-
spaces between them & have their
endothelium well brought out by
the staining.

11th Continued examination
of inflamed & healthy omentum
of rabbit. The lymphatics as shown
by the agno₃ method present an
imbricated appearance due to the
stained outline of the endothelium.
On serous surfaces generally, the
relation between parts is supposed
by recent observers to be as follows
Beneath the epithelium, ramify

the lymphatics & capillaries together
with a system of branched nucleated
cells, which communicate
with both the lymphatics & the
adjacent ones. Opening on to the
serous surfaces are certain bodies
called stomata, of which there are
two kinds, the true & the false

14th

Examination of the white corpuscles of the newt

16th

Examination of the white corpuscles of man

18th

Examination of white corpuscles of newt in saline with aniline or Indian ink suspended in order to watch the ~~de~~ interruption of the granules. Exam. of mill globules. Examination of human pus

21st. Subject. Action of reagents on & Structure of coloured corpuscles of blood of Batrachians. Blood (1st) in cap. tubes (2nd) mixed with saline. Reagents. Aqua Di Cal. and. Ly R. & Boracic acid. Points to be noticed from colour

and structure. Form, oval
on flat view, sideways narrow
with the nucleus bulging. Colour
a faintish red. Structure, 3 parts
1st Stable or stroma ^{or axis} 2nd labile or
fibrin & colouring matter (3) Nucleus
Stroma resists reagents save H₂O
is transparent & colourless
The labile not readily yields to
reagents being dissolved out by
H₂O the colouring matter passing
out with it.

Nucleus a round body consisted
of an albuminous matter & having
mucin around it which is readily
coagulated by acetic acid & so make the
nucleus clear

H₂O renders the corpuscles pale
by dissolving out the colouring
matter, they also become larger
In the white matter they
swell up, the nucleus becoming
more distinct & the granules coll

relax between the nucleus & stem-
al envelope, take in a molecular
movement.

Acetic acid ^{1%} coagulates the Nuclein
about the nuclei, making them
distinct; the capsules (white & red)
becoming somewhat smaller.
Potash. has a remarkable action
at first no apparent change. soon
however the red become slightly dark
& more rounded & then finally
burst, disappearing entirely. The
white go much sooner, flattening
out much in their dissolving.
Boracic acid ^{1/4%} By its action the colour-
ing matter accumulates about
the nucleus, usually shrinking
body, at other times lags of adhesion
is left between to the stroma
which result in a stellate appear-
ance. The stroma is made more
distinct & often assumes dif-
ferent forms, the usual one being

word, though one a perfect Octoh
edon was noticed. Usually the
nucleus is obscured by the con-
traction of the goods about it, but
in some specimens, when the colour-
ing matter has dissolved out
from the goods, the three elem-
ent-composition are well seen
On white, malle nucleus distinct
granules collect about it.
Often the goods collected about the
nucleus in the red has a jagged
irregular look arising probably
from ^{its} unequal contraction
2 3rd

4 annulation of coloured corpus-
cles of Man. Material obtained by
autophlebotomy, put tying a cord
round the finger. Reagents. (a) Aqua
dul. (b) Acetic acid (c) Tannin
Aqua Dul. First procure as small
amount as possible and instead
of the usual, human hair which

is employed to prevent the emulsifying
of the oo, use a thin film of vellum or collagen.
The corpuscles tend to arrange them-
selves in rouleaux. In structure, they
resemble, like that of the Balradium
of stable or acid & labile or good
the latter being easily acted on, no
nucleus is present. Water renders
the corp. rounder, more spherical & they
lose their biconcave aspect. Gradually
the colour disappears, but the structure
is always left & may be seen by care
at focusing.

Acetic acid acts on the red like water
but more quickly, on the white it acts
more evident; bringing out the nu-
cleus either as a single mass or
tripalate, sometimes dumbbell sh-
aped. Tannin

Robert's method,
the most characteristic. Best to
mix the oo with saline first & add
the tannin solution before the test

over is applied. The effect is as follows:
the zovis separates itself from the
stroma & arranges itself either
at ^{the} one side of the inner wall, somet-
imes projects partly in & partly out.
at others it appears complete & termed
& having common in this case an
pimpled appearance. The faintly
precipitating the albuminous consti-
tuent of the oo, thereby rendering the
specimen slightly obscure
Saline or oo either makes the corp
assume a cupped appearance &
smallly a spheroid, or else gives to the
a horizontal but aspect, as though they
were covered with pimples = cratin

25th & 26th

Demonstration of
"Muscular curves" with the Key of
apl. (see

28th Blood crystals (Human)
Take a Drop of Os , Dry it thoroughly
then pulverize it, add a grain or
two of NaCl , rubbing them together
apply the top cover, add a Drop of
glacial acetic acid, heat over a spirit
lamp & examine for crystals. Three
things will be noticed, 1st the rem-
ains of the blood (2) Crystals of NaCl
(3) the dark brown, needle shaped
or prismatic crystals of blood hematin.
The NaCl may be dispersed with
and a neater preparation be obtained
pre from its crystals

Influence of Electricity on the blood
best observed in Batrachians
The constant current is not so good
as the induced, & the make & break
is better than the make as it is
more intense. These effects may be
noticed (1) The red corpuscles appear
enlarged, giving them the appearance
of having radii issuing from the

nucleus to the circumference, but this is caused by the involution of the stroma in different places & so refracting the light unequally. The nucleus also appears round though sometimes it looks a little jagged (2) The corpuscles lose their creased form, swell out & become round, the nucleus either remaining in the centre or else close to the stroma at one side. (3) The colouring matter disappears completely leaving the zooid, stroma & nucleus. On the white, the action is first to stop the amoeboid movements then the corpuscle becomes round & the nucleus gets more distinct. With the

I noticed a similar effect to that produced by L.H. viz the rounding & darkening of the corpuscles, & obscuration of the nucleus & final disappearance smelting away, leaving no trace.

Oct 30th Action of CO_2 on corpuscles
of the neurof. Apparatus, 1st a slide
with a piece of glass tubing cemented
to it, having ^{open} the end, a little to one
side of the center & the other attached
to a piece of hollow India rubber tube.
On this slide a cell is to be made, of
putty & so situated that the end of
the glass tubing shall be a little to
one side of the center of the cell. 2nd the
Generator, two bottles, one containing
 HCl & H_2O , the other a wash bottle, to
which the end of the india rubber tub-
ing is attached. Having prepared every
thing, take a drop of neurof. os and
put it on a thin slip and invert
over the putty cell. Before inverting
it must be breathed on to moisten
it else no effect takes place. These
changes are noticed 1st, when slightly
mouled with the breath & a current
of CO_2 passed through, the nucleus
becomes more distinct owing to the

coagulation of material on its surface
On passing a stream of air over the
blood, the natural condition may be
restored. 2nd If add a little more tho
enough to slightly decolorize tho
you get a precipitation as in the pm
but it extend thorough the corpuscle
making it appear granular. From this
it may also be restored by removal
the CO_2 & passing air, though with dif-
ficulty. 3^d If subject the corpuscle
to prolonged action of CO_2 you obtain
an action similar to Boracic acid, viz
a coagulation of the food about the nu-
cleus, from which condition it cannot
be restored. These effects are somewhat
difficult to obtain but may with care
be well seen
Nov 1st

Examination of ciliated Epith-
elium. Best obtained from the upper
surface of the mouth of frog, on the
portion of mucous membrane

covering the under surface of the orbit.
Notice at first the rapidity of the motion
which renders the individual cells
imperceptible, but they soon come
into view. Reagents, 1st very dilute Hy
P. Sarsa when the movements has
become a little slower add a drop
of this solution & you will observe these
changes, 1st the great acceleration of
the movements. 2nd the retardation
& 3rd the cessation. This holds good of other
solutions as acetic acid &c &c

Next the action of CO_2 . The apparatus of
Lant & Esicore serve for this, the epithelium
be placed on the under surface of a glass
slip. The motion is gradually retarded
& finally stopped altogether, but may
be renewed by passing a current of
fresh air through and this may
be repeated an indefinite number
of times, however the prolonged ad-
m of CO_2 eventually destroys all
appearance of vitality

Nov 3rd. Columnar Epithelium
whole unciliated. Study both
fresh & ones that have been in Chrom
and solution of. Observe both
their form and relation to each other
also to the deeper textures. Three ob-
jects were given for examination, 1
a portion of the trachea of the rabbit, 2
a portion of the intestine & 3 a piece of
the pyloric end of the stomach.
The fresh specimens were supplied
from the M. membrane of frog tongue.
Examine carefully the cilia, the
cupule itself & the mode in which
it is connected with the deeper texture.
The cilia are thought to be prolongations
or continuations of the protoplasm
lying within the cell, through the
"band" or flat upper surface of the
structure. Numerous processes, 2
or three, pass from the lower end
of the cell in among the deeper
layers towards the basement mem.

brane. Among the elements look
out for "goblet" cells (G) which are
supposed to be cells like the others
but the band & alia have disappeared
& left only the margins of the cells &
a mass of protoplasm at the base
Next get a specimen in which you
can examine them in connection
with each other. For this slip off with
a pair of fine scissors a thin portion
of the m. m. of intestine, & study with
the arrangement of the epithelium
in a villus or if by folding a portion
of membrane in such a way as to
be able to examine the ~~margin~~ ^{ridge}
you get what is called an optical
section. Next examine the surface
view & you obtain an ^{end} view of the
epithelium & a mosaic like appear-
ance is seen, with the center ~~attenuated~~
dark or light as you change the focus

Nov 6th

Pavement Epithelium

also transitional epithelium of duct-
adder, which is intermediate between
the pavement & columnar; and
the columnar from papilla of frog's
tongue. To procure these you must draw
the tongue out & examine the under
surface of the organ as it lies in the mouth
& then strip off a small portion & ex-
amine. Bladder of a mammal, having been
in Chrom. of solution for 24 hours, in
this the tablets lie superiorly & if a good point
can be obtained in a side view, one may
see the markings of the other cells on
their under surface. Rounder elements
lie beneath.

Pharynx, steep in Chrom. of solution &
examine. Find the large hexagonal
pavement epithelium also if the
specimen be torn up, many
transitional forms will be seen
which occupy naturally the deeper
portions of the membrane.

W. 8th

Further demonstration of the action
of an induced current on muscular
contraction, under three modifications
viz cold heat fatigue and the action of
some poison such as strychnia

Nov 11th Examination of Elastic tissue
from the tendon of the guinea pig
and from areolar tissue from the
omentum of the rabbit

Trace out the tendon very fine, notice
the wavy appearance of the fibres &
their connection with each other

Then add acetic acid which brings out
the nuclei and which if added in excess
or too strong makes the tissue swell
out & eventually dissolves it

Flout a delicate portion of the omentum
out a slip & without leaving place a
cover glass gently upon it and note
the following: 1. the arrangement
of the fibres in ^{open} meshes without any
2. the junction of the individual el-
ement which form the mesh. 3. the
nuclei of the elements, & the fibres 4
the remains of the endothelial
layer which usually is somewhat
undisrupted from the prolonged macer-
ation

Nov 13th

Examination of 1st Ligamentum nuchae
to study the characters of yellow elastic
tissue. This need especially fine tearing
out in order to separate the elements
and obtain an open preparation
2nd Study the elastic tissue of the meso-
colon of the rabbit. here you have a
dense "felt" coat of whole filaments
spread it out carefully. Aflound with
a piece of it in water and drossly
examine: this dissolves all the
ph. brown(?) and leaves the yellow elastic
tissue(?). Also the mesocolon of the
dog. This is like that of the rabbit but
the mesocolon layers, the peritoneum & endo-
thelium are more distinct.

Nov 15th

Connective tissue capsules
from 1st the ordinary are-
lar tissue beneath the skin of the
guinea pig 2nd from the sub-
mucosa of the intestine of the pig
In this layer the vessels are very

Placoid
in cells
from Glycerin

It consists chiefly of a felt work of fibr. mucous tissue, in there are imbedded the corpuscles. They consist of a nucleus, oval or round and appendage of protoplasm or a zone of protoplasm about it. This is usually of an irregular or stellate form with numerous processes some of which connect with others of different corpuscles. To this kind of corpuscle the name Placoid has been applied.

The points to be observed in the specimen from the Glycerin jar are the following, 1st Band of fibr. granular & 2nd among them in spaces between them are the Placoids, which have present three characteristics, 1st some very pale bands, any granules - granular, 2nd others with empty spaces - vacuoles; 3rd, those with fatty granules

18/11/72

Today we go on to other tissues of the connective group, which are supporting and passive in their functions. Examine today the Cornea, the sub-epithelial tissue of tadpole tail & the choroid coat of the eye. Cornea

consists of a ground
work (which with some regions is
fibrous) and cells. These cells are
placed, enclosing a nucleus, &
many radiating processes which pro-
trude into the neighbouring places
and are supposed to be lymph canals.
It is prepared as follows. Steep

in 1/2% solution of Gold Chloride
wash & expose to light. Make the section
parallel to the surface

Tadpole tail prepared in Ch. gold.
Hold the tadpole with pair of forceps &
with another fine pair strip the integu-
ment from the tail and examine the
bellate cells in the subcutaneous layer

(in anchor)

Chond. scrape off the pigment layer
& tease up the remaining portion & exam-
ine for stellate corpuscles. It thin
well from the Zinnia pass eye. See
slide no

2 5/11/72

Two preparations to make
to day 1st Tendons to illustrate its
structure & the Agno₂ method
Take the tendon from the tail of a rat
which you prefer and then remove
one the thin tendons which lie on
the surface of the caudal vertebra

2nd Study of fresh cartilage from the
thin edge of the cartilaginous shoulder
saddle of the newt (young). To get this cut
off the head & with a fine pair of forceps
strip the skin lying over the sternal
region & under it you will find the two
thin edges above mentioned. Study
it put in the fresh slate and you
will notice: 1. the perichondrium,
2. the ground work or 3. the cavity
within with cells imbedded within.
Notice that there is no distinct cavity
in the fresh slate but the cell fills
out the whole cavity which can only
be seen if magnets of any kind are employed.
Use for this serum. A good way
to get some is to take a large frog, make
a small slit in its dorsal lymph
sac, insert a fine pipette & draw
up in this way sufficient serum for
your purpose. This is a fresh prep.

oration is to be put in Au Cl. 40
for 20' and then transferred to
acidulated ^(acetic acid) H₂O for 3-4 days, & then
mounted.

22/11/72

Demonstration on Mus-
cular Elasticity and the Muscular
wave

25/11/72

Three preparations today

1st Costal cartilage of a dog kept in Be-
chamale H for . This is to show
the arrangement of the elements
7 toward the surface of the rib you
get the cells arranged in strata &
they look more elongated. Next in
the deeper layers the cells are in
groups irregularly arranged, though
sometimes stratified.

2nd Panniculus cartilage from
the articular end of tibia of the dog
Then you get two sorts one the true
articular lying on the surface of
the joint and below this about the
centre of the epiphyses are the por-
tion of cartilage we want. In this
variety there is but little of any
ground work, it is entirely taken
up with the cells

3rd Elastic cartilage from the epi-
glottis of a mammal, in which
the ground work is made up of

a net work of fibres among them. The
yellow elastic tissue which exists
nearly all round. It may be seen
surrounding closely the pits or canals
of cavities

27/11/72

Bone

Three sets of preparations, 1st ready
made sections of unsoftened bone
transverse and longitudinal sections.
In these notice the lacunae & canaliculi
which are now supposed to be connected
with the lymphatic system, as are the
stellate corpuscles in the corners, and
here as elsewhere are arranged about
blood vessels, i.e. those of the Haversian canal.
2nd softened bone from which you
must cut thin sections with a strong
scalpel. Here the same facts may be
observed, though the canaliculi cannot
be seen. In the lacunae the remains of
the "bone corpuscles" may be seen
3rd Thin portions peeled from softened bone

for this the is the best. The
strips must be very thin & had better be
steeped in Chromic acid before mounting
in glycerine. This shows the fibrous nature
of the lamella, consisting of reticulated
fibres of extreme fineness which appear
to fuse together at their junctions.
Then try to obtain the "perforating fibres
of Sharpey". To do this take a pair of very
fine forceps or a fine pointed needle &
try to lift up as delicate a portion as
possible when done place it with the
under side uppermost on the slide and
examine. They are somewhat difficult
to obtain.

29/1/72 Three preparations. 1. A
piece medullary tissue of bone in
which we first meet with adenoïd
tissue - a kind of connective tissue
in which placed are numerous in
relation to ground substance. ^{They are} about
equal in size to the human red corpuscle
branched and connected by processes.

Marrow is distinguished as yellow
or red; the former, found in old
animals contains quantities of fat
the latter met with entirely in young
ones, has little or no fat in its compo-
sition. Among the cells in red mar-
row are some large "mother cells" =
myroplasts(?) containing smaller
ones - the daughter cells

2nd Development of bone from car-
ilage sections from foetal lamb

3rd development of bone in membrane
from the skull in which you see
the osteoblasts - in a condition mid-
way between the cartilage cell & the
bone corpuscles

2/12/72
Two preparations to make to-
day 1st involuntary muscular fibres
cells from the Cats intestine in wh-
they are unusually large and distinct
To obtain them, tear with a pair of
fine pointed forceps a thin portion

from the serous surface of the gut &
with it you will remove some of the
transverse muscular layers

Trace the specimens very finely in order
to obtain the elements separately

It is well to keep the intestine for 3-4
days previously to examining it in
a dilute solution of Bichromate of Potash.
After studying the individual fibres
add acetic acid & watch the develop-
ment of the rod-shaped nucleus

2nd Study the characters of living stu-
ped muscular fibre. For this the
Dytiscus marginalis is used, the
muscle being taken from the legs &
from beneath the thoracic segment
of the body. Take a very small portion
& put it quickly on a slide without
any fluid. If a successful preparation
has been obtained, waves of contrac-
tion will be observed traversing the
fibre, the wave of contraction, such
ly followed by that of relaxation. Then

study the elements themselves
Here you will notice that each fibre
consists of a grey and a darker portion
and that in the former the contractile
prossents as the darker elements
are seen to be passive in the contract
nearly approximating to each other
Afterwards examine the muscle cor-
puscles - pleuoid, layers of delin
protoplasm arranged differently
in different animals. Acetic acid
renders them very distinct -

4/12/72

One preparation today, viz fresh
muscle. First examine it in saline
then add H_2O slowly in order to study
the relation of the sarcolemma, which
swells out under this reagent.
Then acetic acid. Then acetic acid in
order to bring into view the muscle
corpuscles, the nuclei only are left, the
protoplasm with which it is surrounded
is entirely dissolved. Next attempt.

the study of an interesting phenomenon connected with the sarcolemma & muscle elements. If you tear & break up the fibres very much & then examine you will sometimes obtain a fibre in which the muscle itself has been broken but the sarcolemma not, but may have got tangled so that the surfaces of the two fibres become attached. In this clear-bordered or unbordered spot - small square bodies may be seen exhibiting the Brownian movement. These are supposed to be the sarcine elements of Brownian, which by the manipulation has got broken off.

6/2/72

Four preparations. First two already mounted one being a transverse section of frozen muscle showing the spaces between and the cut ends of the fibrille, the other demonstrating by means of polarized light the difference which exists between the light and dark

portions of the fibril. Thirdly make
a preparation of mammalian
muscle & compare with the Ratan-
ian. Fourthly study the medullary
nerve fibres

9/12/72 Ganglion cells of the antero-
horn of the spinal cord & cellular
elements of the cord itself

11/14/72 Cellular elements of the central
nervous system, i.e. the cerebrum &
cerebellum. Prepare as follows sleep
portions in $\frac{1}{2}$ - 1% of AgNO₃ & keep in
the light. then wash in Hyposulphite of
Soda to remove the chlorides
Sections of Cerebrum & cerebellum can
cut with & examine

16/12/72 Nerve endings

1st In muscles of frog, steeped in dilute sulphurous acid, till the element is saturated with faculty. In many of these you find the nerve endings

2nd in the thin muscles of the back of a snake, & amine for motional end plates. Somewhat difficult to obtain

4/1/73

Arteries. In these study first the intima; the endothelium to be stained with azro_3 , the sub-epithelial layer next then the proper elastic layer consisting of interwoven fibres sometimes penetrated

It amuse then the muscular coats or media. In the large & small arteries a difference exists in these elements. In the large, the arrangement is less systematic. The form is less regular & 3rd there is a larger amount of elastic tissue intermixed.

The adventitia consists of connective tissue & fibrous elements forming a sheath for the blood vessels & nerves.

8/1/73

Methods pursued in the preparation of tissues for section

Four parts in this process

- 1st Preparation of the tissue for embedding.
- 2^d the Embedding.
- 3^d the staining & 4th the Mounting Preparation

Place perfectly fresh portions of tissue in one of the "Primary fluids" of these Alcohols & the "Chromates" are the chief Alcohol used in all cases for fixed preparations also for lymphatic glands & spleen.

Chromic acid & Bechr. of Potash both greatly used the latter especially for muscles, epithelial tissues, mucous membranes

In hardening alcohol & chromic acid the latter in strength of 1/10-1/20 In this part never being so, but fresh use that they are clean & as bloodless as possible. As to time, no rule

some larger others smaller, make
the pieces as small as possible
put in a good quantity of fluid
I embedded. or the process by
which a fine mass is obtained
about the tissue. The mass used
is made of oil wax in varying
proportions, half of the usual
mould in a little paper box. the
moulds with the embedded tissue
may be kept in alcohol.

Next cut sections with a sharp
razor. Staining

sol of carmine
is used gr ii of carmine, cut cut
1℥ of Liq. Ammon. & 1℥ of H₂O. This
is too strong dilute in a watch glass
with water, over point until you can
just see the letters through.

After the section is made, remove to
alcohol in a few minutes to water
& then to the carmine

mounting. This may be done

in either "Dama" or a solution
of Canada Balsam & put it
to use of Turpentine & one of chloro-
form. 70 transfer put in alcohol
for 10' then in oil of turpentine
a better oil of cloves & finally to
the Balsam or Dama

11/1/73

Albumin and Syntom
two days

13/1/73

Sections of arteries.

small arteries in the mesentery &
mesogastrium of the frog. & also
the capillaries & veins. Development
of capillaries & blood in the tails
of tadpoles

15/1/73

Lymphatic glands

Spleen. sections of both

17/1/73

Digestion

19/1/73

Lymphatics

21/1/73

Thymus. Thyroid and Tonsils

24/1/73

Physiology of secretion, illustrated
on the sub-maxillary gland

On the propriety of using the lower

animals for the purposes of experimentation Dr. Sanderson said
1st we are at liberty to use them
in the same ground as we do for
food 2nd for scientific investigation
are justified in giving pain
3rd for mere demonstration we are
not justified in giving pain
Hence all experiments are omitted
which cannot be performed on an-
aesthetized animals

