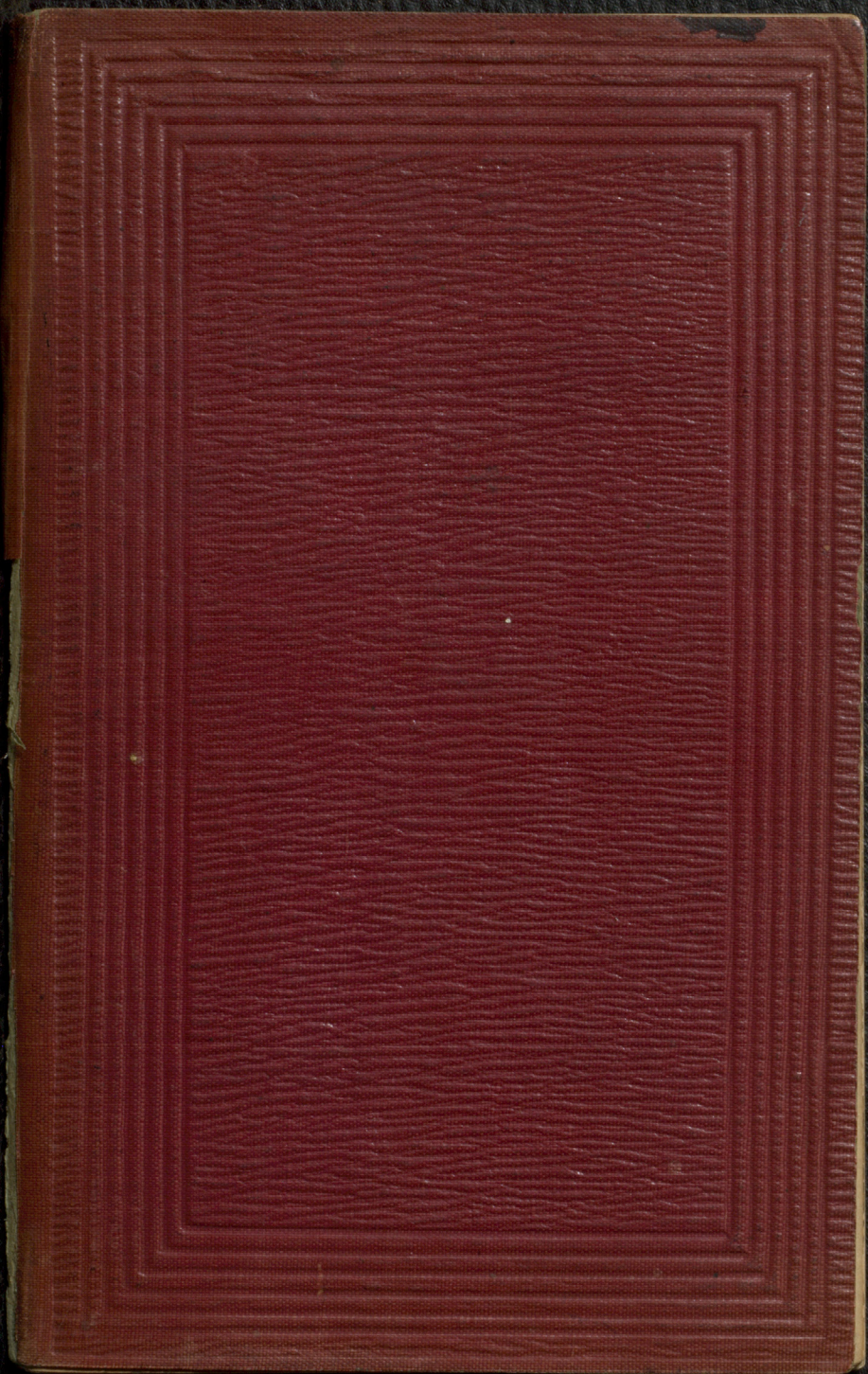




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Short Notes on a
course of
Practical Physiology

by

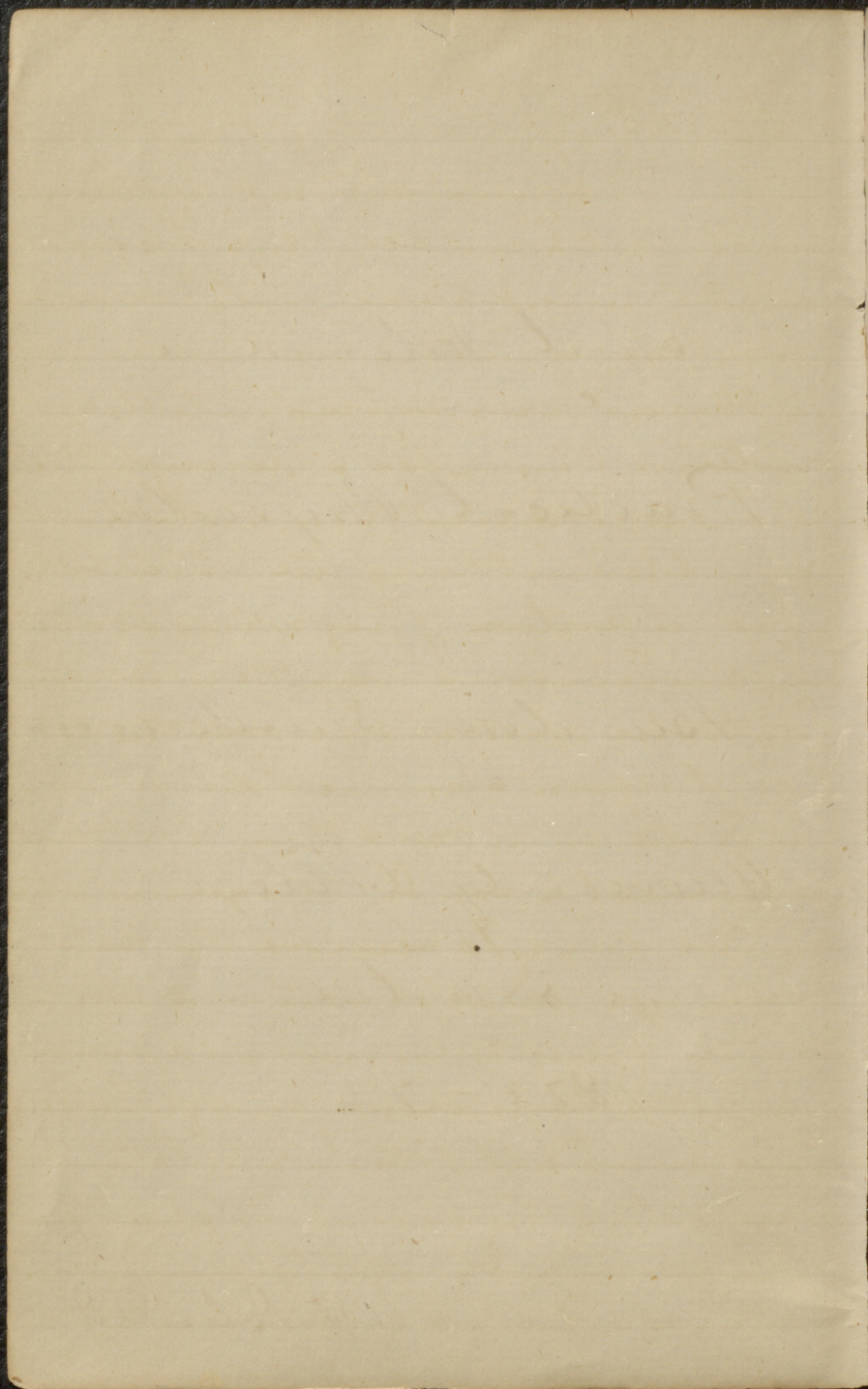
Dr. Burdon - Sanderson
at

University College

London

1872 - 73

W^m Allen. 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 cer-
vical region & pushed down tow-
ards 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 gran-
ules, vacuoles & a nucleus

apparently

The cornea is not much altered but when examined ⁱⁿ the fibrous structure between the epithelial layers are found "wandering" exhibiting movement. That 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 & ^{the} pus globules are coloured

10th Examination of omentum of rabbit 3 days after injection with animated milk. After being brushed with solution of $AgNO_3$ & exposed to light; cut off pieces & examine, floating them in to the glass slips & placing a great 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} the deposit of acid
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.

11 th Continued examination
of inflamed & healthy omentum
of rabbit. The lymphatics as shown
by the agno₃ method present an
intricated 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 small 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 form, 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 ^{nucleus} 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 paler
by dissolving out the colouring
matter, they also become larger
On the white it makes them
swell up, the nucleus becoming
more distinct & the granules coll

relating between the nucleus & external envelope, take on a molecular movement.

Acetic acid ^{1%} coagulates the Mucin about the nuclei, making them distinct; the corpuscles (white & red) becoming somewhat smaller. Potash. has a remarkable action at first no apparent change. soon however the red become slightly dashed & 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 coloring matter accumulates about the nucleus, usually shrinking body, at other times lags of adhesion are left between the stroma which result in a stellate appearance. The stroma is made more distinct & often assumes different forms, the usual one being

word, though one a perfect octoh-
edron was noticed. Usually the
nucleus is obscured by the con-
traction of the zooids about it, but
in some specimens, when the color-
ing matter has dissolved out
from the zooids, the three ele-
ments of composition are well seen
on white, malle nucleus distinct
granules collect about it.

Often the zooids collected about the
nucleus in the red has a jagged
irregular look arising probably
from ^{ch} unequal contraction
2 3rd

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

is employed to prevent the crushing
of the oo, are a thin film of oil or collagen.
The corpuscles tend to arrange them-
selves in rouleaux. In structure, they
resemble that of the Balanidium
of Slake or Accis & Labile or Goid
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 stroma
is always left & may be seen by careful
microscopy.

Acetic acid ¹⁰ acts on the red with coals
but more quickly, on the white. Action
is more evident; bringing out the nu-
cleus either as a single mass or
tripartite, sometimes dumbbell sh-
aped. Tannin

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

over is applied. The effect is as follows:
the zooid separates itself from the
stroma & arranges itself either
at ^{the} side of the inner wall, some-
times projects partly in & partly out.
at others it appears completely & termed
& having common in this case an
pimpled appearance. The failure of
precipitating the albuminous crust
around of the zooid, thereby rendering the
specimen slightly obscure.
Saline or too rather makes the corp
assume a cupped appearance &
smallly a spheroid, or else gives to the
a hornier & blunt aspect, as though they
were covered with pimples = crenation

25th & 26th

Demonstration of
"Muscular curves" with the Myog-
aph. (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 pre crystals. Three
things will be noticed (1) the rem-
ains of the blood (2) Crystals of NaCl
(3) the dark brown, needle shaped
or prismatic crystals of blood haemin.
The NaCl may be dispensed with
and a neater preparation be obtained
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. Three effects may be
noticed (1) The red corpuscles ^{seem} appear
enared, giving them the appearance
of having radii running from the

nucleus to the circumference, but this is caused by the involution of the stigma 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 stigma at one side. (3) The colouring matter disappears completely leaving the zooid, stigma & 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.K. viz. the rounding & darkening of the corpuscle, ² obscuration of the nucleus & final disappearance smelting away, leaving no trace.

Oct 30th Action of CO_2 on corpuscles
of the newt. Apparatus 1st a slide
with a piece of glass tubing cemented
to it, having ^{fine} ~~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 newt's oo and
put it on a thin slip and invert
over the putty cell. Before inverting
it must be breathed in to moisten
it else no effect takes place. These
changes are noticed 1st, when slightly
mowed 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 remove
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 Ronacic acid, viz
a coagulation of the zoid, 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 cilia
imperceptible, but they soon come
into view. Reagents, 1st very dilute Liq
Potassa. When the movements have
become a little slower add a drop
of this solution & you will observe three
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
Lamb & Eschsché serve for this, the epithelium
be placed on the under surface of a glass
slide. 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. 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 lungs.
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 (or
threads) 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 (X) which are
supposed to be cells like the others
but the band of cilia 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 forceps a thin portion
of the m. m. of intestine, & study etc.
the arrangement of the epithelium
in a villus or of by folding a portion
of membrane in such a way as to
be able to examine the inside
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

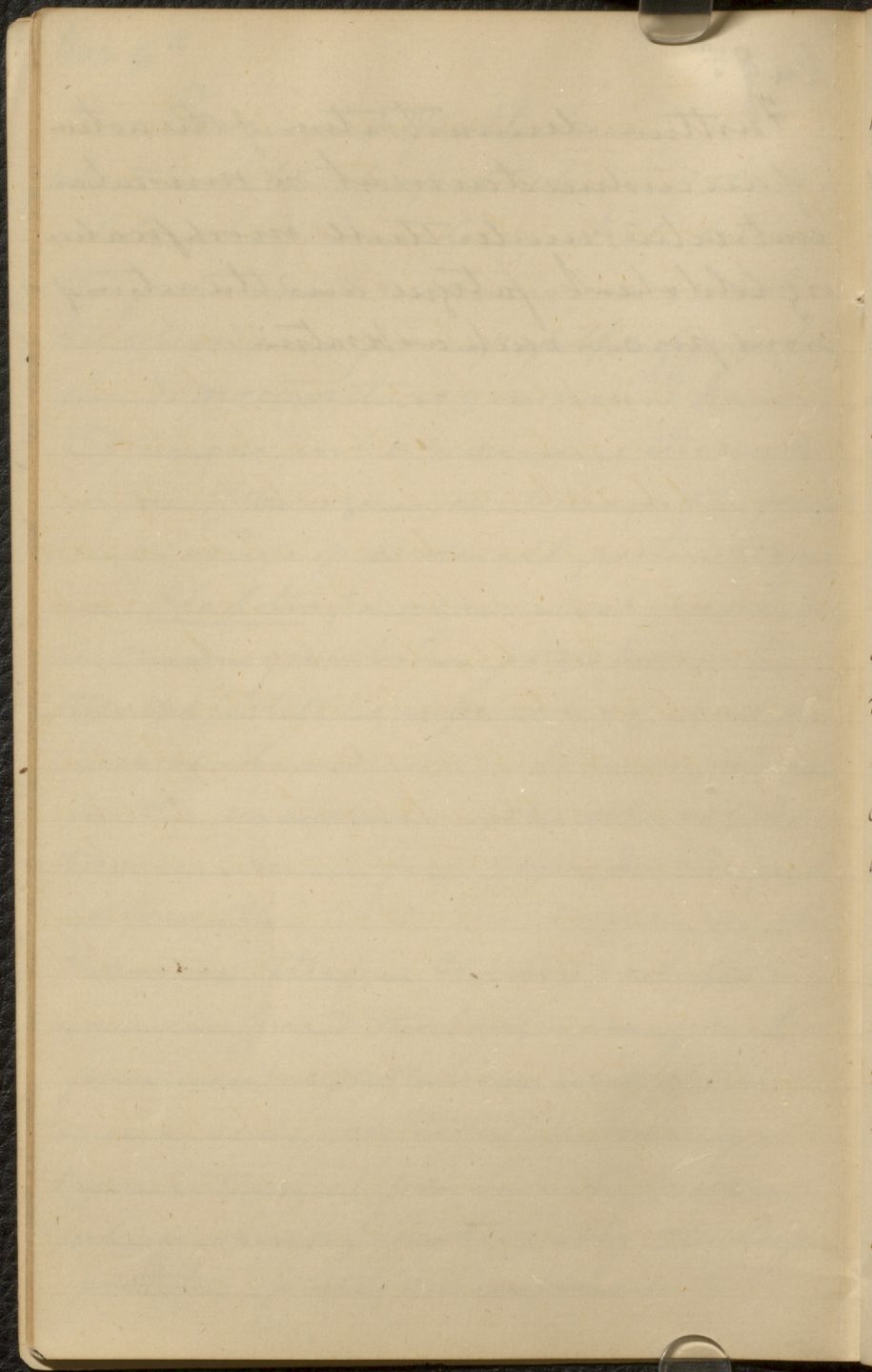
Nov 6th

Pavement Epithelium
also transitional epithelium of the bladder, 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 snip off a small portion & examine. Bladder of a mammal, having been in Chrom. of K solution for 24 hours. In this the tablets lie superiorly & if a good portion can be obtained in a side view, we may see the markings of the other cells on their under surface. Rounder elements lie beneath.

Pharynx, steep in Chrom. of K 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

Float a delicate portion of the omentum
out on 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-
ements which form the mesh. 3. the
nuclei of the elements, & the fibres 4
the remains of the endothelial
layer which usually is somewhat
indistinct from the prolonged mac-
eration.

Nov 13th

Examination of 1st Ligamentum nuchae
to study the characters of yellow elastic
tissue. This needs especially fine tearing
out in order to separate the elements
and stain an open preparation.
2nd Study the elastic tissue of the meso-
colon of the rabbit. here you have a
dense "felt" work of whole filaments torn
spread it out carefully. Aflumond (alcohol)
specie put it in alcohol and drench &
examine: this dissolves all the wh. fil.
ph. brun(?) and leaves the yellow elastic
tissue (?). Also the mesocolon of the
dog. This is like that of the rabbit but
the mesocolon are larger, the ph. & endo-
thelium are more distinct.

Nov 15th

Connective tissue corpus-
cles from 1st the ordinary are-
olar tissue beneath the skin of the
guinea pig 2nd from the sub-
mucosa of the intestine of the pig
In this layer the venulones run

Placoid

John cell

from Gummig

It consists chiefly of a felt work of fibres of excessive tenuity & in these are imbedded the corpuscles. They consist of a nucleus, oval or round and appendages of protoplasm or a zone of protoplasm immediately 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 Gummig are the following: 1st Band of fibres granular & 2nd among them & in spaces between them lie 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

To day 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 & 3rd the choroid coat of the eye. Cornea

consists of a ground
work (which with some magnets is
fibrillar) and cells. These cells are
placoids, consisting of a nucleus &

many radiating processes which form
anastomoses with neighbouring placoids
and are supposed to be lymph canaliculi.
It is prepared as follows. Steep

in $\frac{1}{2}$ % 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
cellate cells in the subcutaneous line

(in anchor)

Chond. Scrape off the pigment layer & tease up the remaining portion & examine for stellate corpuscles. It this will form the Juncus pass eye. See slide no

20/11/72

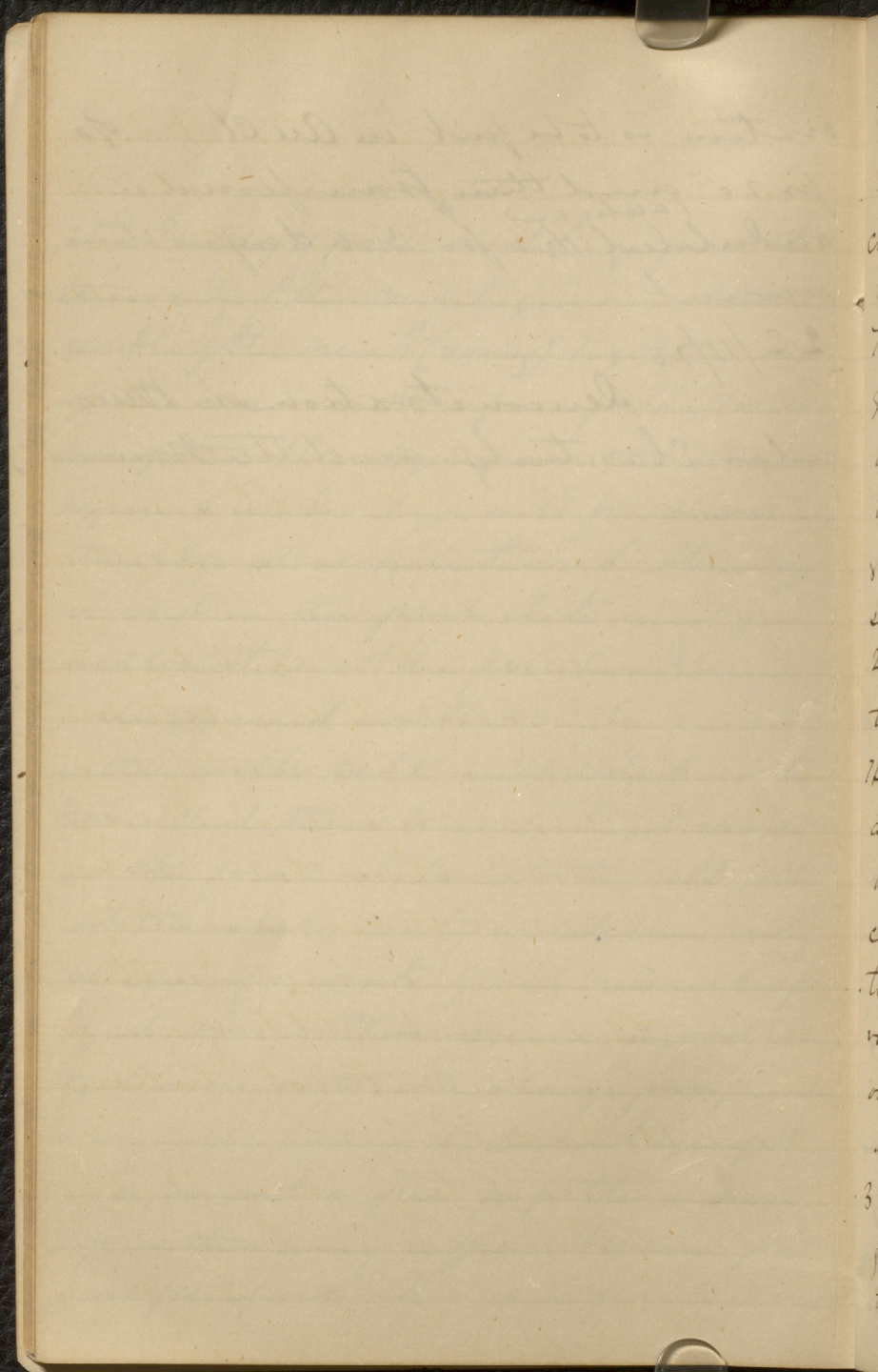
Two preparations to make to day 1st Tendon to illustrate its structure & the Agn^o method Take the tendon from the tail of a rat which you prefer and then remove the thin tendons which lie on the surface of the caudal vertebra

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^d the cavity
in this with cells imbedded in this
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 em-
ployed. 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. 90
for 20' and then transferred to
acidulated ^(acetic acid) H₂O for 3-4 days, & then
mount.

22/11/72

Demonstration on Mus-
cular Elasticity and the Muscular
wave



25/11/72

Three preparations today
1st Corneal cartilage of a dog kept in Be-
chamale's R for . This is to show
the arrangement of the elements
towards the surface of the vit. 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 Paramesometrous cartilage from
the articular end of tibia of the frog
When you get two cuts one the true
articular lying on the surface of
the joint and below this about the
center of the epiphyses are the por-
tions of cartilage we want. In this
variety there is but little of any gr-
ound 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 mammals. 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 cornea, 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.
- 3^d Thin portions peeled from softened bone

for this the is the best. The
steps 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 articulated
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.

29/11/72 Three preparations. 1. A
fresh medullary tissue of bone in
which we first meet with adipo-vascular
tissue - a kind of connective tissue
in which placodes are numerous in
relation to ground substance. ^{They are} about
equal in size to the human red corpuscles.
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 composition. Among the cells in red marrow are some large "mother cells" - myeloplasm(?) containing smaller - the daughter cells.

2nd Development of bone from cartilage sections from foetal lamb

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

2/12/72 I was preparing to make to day 1st involuntary muscular fibres cells from the Cat's intestine in which 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

Tear the specimen 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
fibres, 1st the wave of contraction, such
by followed by that of relaxation. Then

study the elements themselves.
Here you will notice that each fibre
consists of a gray and a darker portion
and that in the former the contractile
proteins as the darker elements
are seen to be passive in the contractile
nearly approximating to each other.
Afterwards examine the muscle cor-
puscles - pleuroid, 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 fiber very much & then examine you will sometimes obtain a fiber in which the muscle itself has been broken but the sarcolemma not, but may have got twisted so that the surfaces of the two fibers become attached. In this clear-bordered or unbordered spot - small square bodies may be seen exhibiting the Brownian movement. These are compared to the nucleus elements of Brownian which by the manipulation has got broken off.

4/2/72

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

portions of the fibril. 7 kinds make
a preparation of mammalian
muscle & compare with the Ratanian.
Forthwith study the medullary
nerve fibres

9/12/72

Ganglion cells of the anterior
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 Hypophosphite &
Soda to remove the chloride.
Sections of Cerebrum & cerebellum can
not well examine

16/12/72 Nerve endings

- 1st In muscles of frog, steeped in dilute sulphurous acid, till the element is revealed with facility. In many of these you find the nerve endings
- 2nd in the thin muscles of the back of a snake, examine for motoneuronal end plates. Somewhat difficult to obtain

6/1/73

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

Examine 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 & nerve

8/1/73

Methods pursued in the preparation of tissues for section

Four parts in this process

- 1st Preparation of the tissue for imbedding.
- 2nd the Imbedding.
- 3rd 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, fixated preparations also for lymphatic glands & spleen.

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

In hardening alcohol & chromic acid the latter in strength of 1/100-1/500 is thus put lines being &c. but first see 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
Imbedding, 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. Then
mould with the imbedded tissue
may be kept in alcohol.

Next cut sections with a sharp
razor. **Staining**

sol of carmine
is used gr ii of carmine, cut carb
16 of Hy Ammon, & 16 of H₂O. This
is too strong dilute in a watch glass
with water, over print until you can
just see the letters through.

After the section is made immerse in
alcohol for a few minutes to water
& then to the carmine

Mounting. This may be done

in the "Dama" or a solution
of Canada Balsam 2 parts of it
to one of Turpentine & one of chloro-
form. To 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 Syntonin
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. section both

17/1/73

Digestion

19/1/73

Lymphatics

21/1/73

Thymus. Thyroid and Tonsil

24/1/73

Physiol of secretion. illustrated
on the submaxillary gland

On the propriety of using the lower

animals for the purposes of experimentum I 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

