

Notebook # 6

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Rm. 21 Zoology Bldg

Helminths

NaCl - 3.5 gm
KCl - .05 gm
CaCl₂ - .10 gm
NaHCO₃ - .90 gm
H₂O - 1000 cc

Amphibian Ringers

NaCl + 6.5 gm
KCl - .14 "
CaCl₂ - .12 "
NaHCO₃ - .15+ "
H₂O - 1000 cc

Mammalian Ringers

NaCl + 9.0 gm
KCl - .42 "
CaCl₂ - .24 "
NaHCO₃ - .20 "
H₂O - 1000 cc

→

	for 5000 cc
—	45.0 gm
—	2.0 "
—	1.20 "
—	1.00 "
—	5000 cc

2.0


Ringer's Solution

	1000 cc	1000 cc.	10000	5000
H ₂ O dist.	1000 cc	1000 cc.	90 gms.	45.
NaCl	9 gm.	6.5 gm	4.2 "	2.1
KCl	.42 "	.14 gm	2.4 "	1.2
Ca Cl ₂ anhyd.	.24 "	.12 gm	2. "	1.
KHCO ₃	.20 "	NaHCO ₃ .2 gm		


Key to Numbers of Rats


Notches	Rt. ear	Left Ear
1 front	1	10
2 "	2	20
1 back	3	30
2 front	4	40
1 front 1 back	5	50
2 " 1 "	6	60
1 " 2 "	7	70
2 " 2 "	8	80
3 "	9	90

Q to E. B. Carmichael, Univ. of Alabama Sci. v. 87, p. 557-58, 1938.

 = no. 11 (10 on left ear + 1 on rt.)

(Make ♂ + ♀ a diff. series)

 = 25 (2 front on left ear = 20 + 1 fr, 1 bk on rt ear = 5)

 = 99 etc.

Muscles of hind leg:

extend	{	gastrocnemius	{ lateral head --	flex whole foot
			medial " --	flex " "
		plantaris	-----	" " " ?
		soleus	-----	flexes wh. foot & toes
		flexor digitorum longus	-----	flexes wh. foot & toes
		flexor hallucis longus	-----	2 muscles side by side both ?
		tibialis posterior	-----	rotates foot inward (partial extension)
		" anterior	-----	extends - has 2 tendons that go down either side of foot.
		peroneus digiti quinti	-----	
		" " quarti	-----	
		" brevis	-----	
		extensor digitorum longus	-----	extends wh. foot.

cut some m.s out leaving long tendons to tie to.

- pull gastroc. over and tie to ext. dig. tendon
~~peroneus~~ →

- pull tibialis over and tie to gastrocnemius head.

The tendons of tib. anterior extend the foot slightly diff't. The more medial ~~tendon~~ ~~extend~~ part of muscle pulls straight up & lateral pulls foot sole inward.

Large peroneus just ant. & under gastroc. bet. g. & tib. anterior on the lateral side - merely twists foot outward. Muscles deeper here extend the toes & spread 'em. ant. m. ~~extends~~ twists sole outward post. 2 extend toes, spread 'em. outward.

Small m. under tib. & ext. dig. comm. extends the big toe.

Muscles of Hind Foot

Flexor group - tendons behind & below Calcaneus (all on one tendon grip.)

Gastrocnemius Head - tendons twisted w. plantaris
 medial " -
 lateral " -
Plantaris - tendon becomes continuous w. flex. dig. long.
Soleus - attached to calcaneus (tuber calcanei)

Extensor group -

Could bring ant. tibialis over to gastroc. tendon if cut out the deep lateral muscles.

Bring flexor hallucis longus + pl. digit. longus over to extensor digitorum communis tendon.

Tibialis anterior comes over laterally.

Flexor hal. longus " " medially.

Means cutting off part of biceps femoris and part of the superficial medial muscles.

But the rat, like man, probably uses both extensors and flexors when standing on toes

But the gastroc. tires sooner, maybe the flexors have to contract enough more than flexors to make observable difference.

What about climbing.

Tie the rat down after he's learned and use simple withdrawal reactions.

Determine how long it takes for learning to automatize and pass to the lower centers.

What use to clot blood quickly
scliptic pencil?

Flexors

Ext. medial ✓
" lateral ✓
Plantaris ✓
Soleus ✓
Flexor hallucis long.
" digitorum "

Extensors

Ext. digit longus
Tibialis anterior
Ext. hallucis prop.
Tibialis posterior

Muscle along inside & posterior to tibia pulls the foot into toe-in position.
There's a m. right under & post. to the tibialis that is mistaken for it that can be brought over easily.
Then use the tib. ant. tendon for the flexor m. bring it over.

Just where cut up side of leg so as to cut fewest blood vessels & nerves to the skin?

Better use the forearm - just the flex. & ext. of wrist. They'll be able to get along, w/out for a while, but will probably learn finally and test will come in elect. 3.

Can lay out mus.s like strings. The deepest ones along the bones can be cut & left to degenerate. The top mus.s give good tendons. There won't be so much of a ~~prob~~ ^{danger} in retracing as they don't use front feet vigorously.

Can cut off the other paw to make them use the operated one.

Ext. carpi rad. long. pulls hand & arm in.

Forarms

A nerve ^{& blood vessel} runs down over surface of extens. carpi rad. long. just under biceps.

Extensor pollicis longus starts underneath other extensors comes down & tendon comes over toward thumb as it turns palm in. supination.

Another nerve comes down right under the flexi carpi ulnaris wh. is large-bellied m. super. flex. near later. ext. s.

Palmaris longus has 2 tendons - seem to pull on palm sheath to flex wh. hand.



Blood vessels & nerves go into paw on flexor side, become superficial near pulse point on wrist.

Cross one set medially, the other laterally.

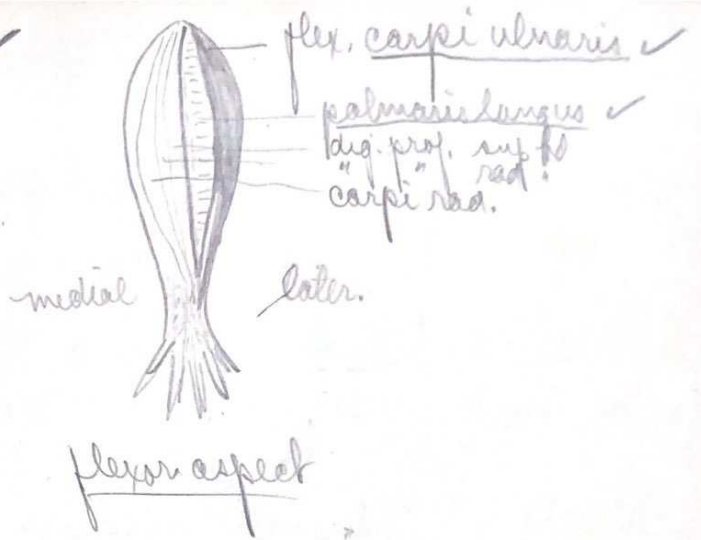
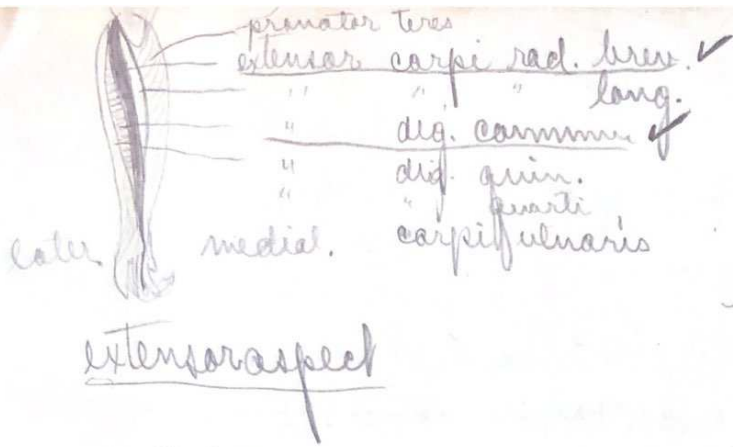
Bring ext. carp. rad. brevis over medially & tie to the two palmaris tendons flex. carpi ulnaris.

Tie same flexor to ext. dig. communis

Have to get a wrist mov't, because there are m's in the palm that move the fingers. None in extensor side.

Perhaps tie a group of muscle tendons together, then tie to an opposing m. tendon.

Is it necessary to have a double relationship?
Just cut out all m.'s that extend or flex.



radial }
 median } nerves in forearm.
 ulnar }

musculocutaneous
 & dorsal antibrachial cutan.

superficial nerves on flexor dorsal side
 of lower arm.

Musculo-cutaneous
 branch to pronator teres
 " " flex. carpi rad.

Median nerve
 br. to flex. dig. sublim
 " " profund.
palmaris longus
pronator quadratus
finger sp. in palm.

Ulnar nerve
flex. carpi ulnaris
 " dig. prof.

Radial nerve

ext. corp. rad long
 " " " brev.
 " dig. commun.
 " " quint.
 " " quart.
 " carpi ulnaris

m. supinator
ext. pollicis long
 " " brev.
 " indicus proprius
abductor pollicis

Blood vessels of forearm more volar than dorsal

Dorsal arteries

Collateralis radialis goes down over ext. communis
& cephalic vein w. radial n. wh. supplies
most of extensors

Ulnar nerve & artery - becomes superficial ab.
wrist crosses into wrist above
ext. carpi ulnaris.

Musculi cutaneous n. w. branch of radialis artery down
anterior to radialis

Two cephalic veins go down anterior superficial
over ext. carpi radialis

Basilic vein goes down post. along carpi ulnaris

Volar

Median down center art. & n.

Ulnar art. & nerve down poster.

Branches of blood vessels to muscles up near
elbow.

Ulnar = posterior

Radial = anterior

hind leg.

flexor hallucis longus

Cross the "inside m." over medially to tib. anter.

Cut out most of Gastrocnemius, 1st get the lateral-anter. head and cross it over poster. tibialis
So leave the tendon of "ins. m." dangling. & Use the ^{tendon of} best of gastrocn. m. where ~~tendon~~ is cut off.

Put a hole in wide tendons, tie & tie again.

Use the suction cups with strong elastics and small glass or metal hooks. The elastics can be slide to any desired height.

Pin the animal either by the body or by the tail.

Might use barb. by making a satur. or ten cc solution & try dosage.

Used about 5 cc of 10% solut. of barbital-1/2 and animal died after 2 hrs. of narcosis in throat. Also used ether at same time - so.

Make sure cut goes down center of hair-less area.
Make some glass instruments for handling nerves

Go thru, bare tendons about ankle, cut flexor digitorum longus
Pie threads to ① flexor hallucis longus & ② to tib. anterior.

Pie threads to

cut away lower portions of biceps & semitendinosus

Get Chinese silk - not too thin.

" De Kotinsky's cement.

knots that will get tighter on tension.



Neither tib. posterior, nor flex. work well. Tib. posterior
can work to extend the foot. flex. dig. long. mostly supinates.

cut both tib. post. & flex. dig. long.

Then tendons of tib. anterior & exten. digit. longus wh.
lies right under tib. are close together & must be separated.
Separate the tib. from bone from prox → distal.

The peroneus groups pronates solely, can extend possibly

→ X Cross abster. tib. & flexor hallucis anteriorly - the tibial m. ^(beneath) under.

cut off medial head of gastroc. it has a small origin up
under knee. - if don't cut common nerve.

cut off the lateral hd. of gastroc. it has a common origin w.
the plantaris, so cut it off in middle

X Cross plantaris & soleus w. exten. dig. long.; the deg. ext.
m. beneath.

Criterion of the mount must be flexion, standing on toes -
means that flexor group is contracted stronger than
extensors.

The toes together before starting, then can use hooks to hold the leg.

(Pie knot in tendon ~~==~~ ~~==~~ ~~==~~ ?) Use only 2 sets of m.s

Nerves of rear limb:

lymph nodes in joint about knee.

Saphenous - external, medial

Sciatic

Tibial - enters upper gastroc. m. ? ^{down gastroc.} lateral ^{med. & sural} under gastroc.

Sural branch - over top of gastroc. + down it. in middle. to skin

Common peroneal - lateral

Articular br.

Autonomous

Ext. dig. longus — deep peroneal n.

Plantaris & soleus — supplied by tibial nerve.

Flex. hallucis long. — branch of " ".

Tibialis anter. — deep peroneal n.

Tibial n. goes between upper heads of gastroc. m. medial.
Common peroneal = br. of tibial goes down in by gastroc from behind & ^{deep per} crosses over fibia & fibula to innervate exten dig. longus pretty far down & tib anter well up.

Pie tibialis to gastroc. tendons laterally

Pie soleus & plantaris to ext. dig. long. tendon

Read over fore-notes before operating!!

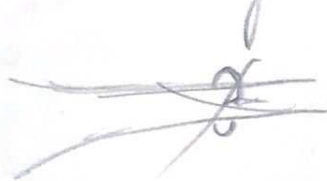
Be careful in freeing tib. arter. from bone - there's a nerve & blood vessel up in there.

Take time in freeing tendons and laying whole situation out.

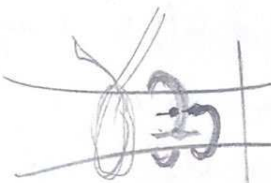
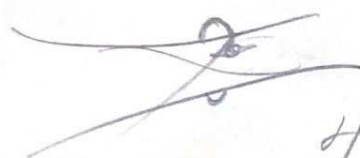
Always cut all the tendons you want out before doing anything else.

Better put a sched. up in front at 1st.

In tying tendons.



Go thru w. needle



Tie knots so ^{cut} then tie above these knots

H m.s perhaps be just as well. Start from beginning.

The overlap can be improved upon.

Use just two strings - preparation is exactly the same as in crossing H m.s. then merely tie overlapping

H not much harder than two - merely matter of fastening tendons.

Dosage = @ .5 cc for 300 lbs of ♀

♀ #1 - Oct. 28, 1938

nearly .5 cc for 200 lb. Also injected about 1 cc of Ringers subcutaneously. Went under in 10-15 min. Came out next morning 13-14 hrs. later.

Cut tendons of, gastroc. med

2) " later.

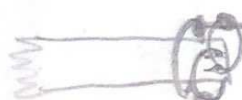
3) flex. dig. longus

4) tibialis post.

5) ext. hallucis proprius (?) (same very small m. just under, tib. ant.)

{ Tied both soleus & plantaris to sol. plant. & gastroc tendons.
" exten. dig. longus to extensor dig. long.

{ " tibial anter to tibialis anter. tendon
" flex. hallucis long. to flexor Hall. longus tendon

 tied each tendon so & then tied threads together - makes pretty large bulges of knots.

Did not separate the strings - they'll probably rub on each other.

Did not try out the crosses to see if they worked at all. (over for remaining hist of #1)

♀ #2 Oct 30, '38

Injected about 2 cc and animal died
go completely out by 20 min. so injected another 1 cc &
went out for at least 8 hrs. Injected 1 cc of Ringers.

Cut & tied same as #1 except cut main tendon of ext. dig.
longus - so had to tie to m. & remaining thread of tendon.
Nerve, medial, superficial, w. bl. vessel to foot not cut -
probably was in #1.

Tried working m.s. - put in a little fat from abdomen
medial under leg. - Knots get in each other's way.
Have to do something -

Do tendons heal quickly enough? Maybe in young rats.

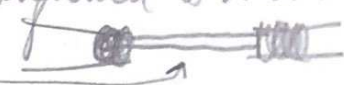
♀ #2 (cont) (??) = #1

♀ #1. (cont.) Killed & joint examined. - Many adhesions - no
sign of silk sutures! M.s. where damaged quickly adhere
to new structures. New tendons start to fuse to old cut m.s.
Try not to cut into the m.s. Handle them whole w. a
stretch of tendon at the end.

♀ #3 - Nov. 2, '38 (C)

Injected bit over .2 cc and animal seemed to retain a few of the reflexes thru out operation. Can inject animal at least $\frac{1}{2}$ hr. before oper.

Cut & tied same as #1.

Tying a little different - knots conjoined to m. so a clean sweep of thread between knots.  w/out knots.

In trying m's after tying found that tibial to flex. halluc didn't do much flexion except of toes.

Need to improve tying technique and also check over m.s and see if a better switching combination can be found. Made mistake in marking (no = 20 instead of 2)

(cont'd) Ret hind leg operated on by Dr. W. Nov. 18, '38

Pb. anter. crossed to achilles tendon. Salsus & Plantaris crossed on either side to ext. carn. dig. tend. split.

Suggests bringing tibial or others thru the bone.
This should be noted

So far:

- 1) Can operate at 2' table w/out further sterilization.
- 2) Don't have to tape over incision.
- 3) Can use Na-sulfide to take hair off - don't get on bare feet.
- 4) No trouble w. the anesthetic - all time want.

So concentrate on details of operatin, m's, tying, etc.
(Get a lower power dissecting lens)

Cut tib & ext. fairly high up.

Tie " " tendons in two places. Achilles in only one.
Flex. hallucis " "

No overlap - bring double thread across.

♀ #4. Nov. 6, 1938



.4 cc and 2 cc of Ringers.

Went under completely in $\frac{1}{2}$ hr. Snuffed a bit after 5 hrs.
Came out after 10 hrs.

Tied tibialis ant. & extensor dig. long. over to achilles tendon laterally. - Cut all m's on achilles tendon - possibility of their regenerating to the tendon.

Tied flex. hall. long to tendons of tib. ant. & ext. dig.

Cut two m's over flex. hall. long. & the tiny one under anter. tibialis - cut out end or so of their tendons & tied m.s so w'd not bleed.

Note: went in laterally w/out totally skinning leg. kept skin attached med. & part near gastroc. Cleared gastroc. tendons from underneath. Also found can leave many blood vessels & nerves attached to skin & can. tissues moving them about w. the skin.

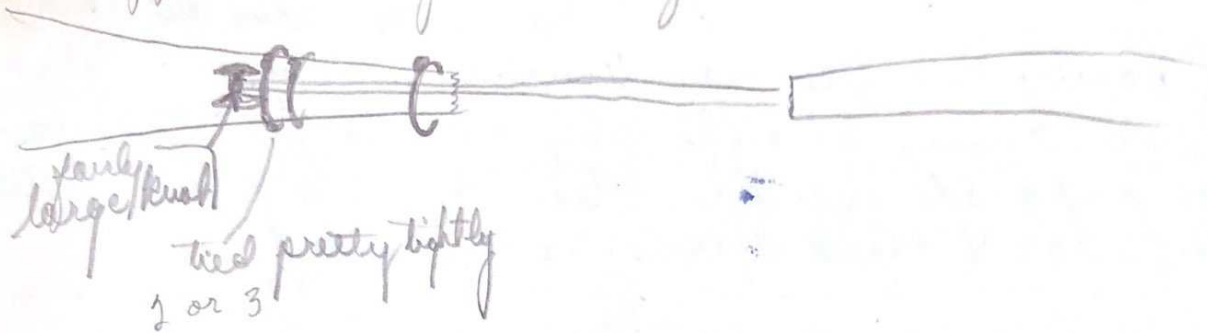
There was little bleeding - later in sewing up skin went thru a large lateral vein, carelessly.

The tib & achilles tendons came close & other cross overlaps.

Inserted a lot of fat about the knots. - was not well sterilized - & had lifer kept in alcohol.

♀ #4 (cont'd) Killed Nov. 22 | Gastroc. rig'd a perfectly good tendon. Silk was covered and a slight tendon rig'd on tib ant. & achilles, but it was sheet like and spread over toward its own tendon. Flex. hall. had caused a growth of bone where it crossed over tibia & so was firmly fixed. Fat was disappearing. Blood vessels & n's seemed to be in good condition.

checked over m's again and flex. hallucis seems to flex fairly well, curling toes — doesn't flex as well as achilles m's
 Tie off muscles before cutting them out.



Make out a dosage list in terms of cc/100 gms of rat.
 Do some more of 4-cross and see if later if there are adhesions between the tendons.

Can use all these unsuccessful rats to operate on the other foot — then in end there'll be more motive for ink to use operated foot.

♂ C 3 = #4 Nov. 12

.6 cc didn't go under very deeply

Tib. ant & ext. dig. l. ————— achilles tendon (few blood v's cut.)
 Flex hall. l. ————— tendons of tib ant & ext. dig. l.
 Cut all ach. o = soleus, plantaris, & 2 gastroc.
 distalis posterior = } 2 m's med. & post. to tibia
 flex. dig. long. = }
 ext. hall. prop. = 1 m. under tib. ant.

used no fat — pulled achilles tend. a bit tight. — no swelling next day

(♂ #3 cont.)

♂ #3 Nov. 13 did too much Na. amytal. Better inject
animal an hour or so before operating.

Can pull silk very tight on the tendons - they don't cut thru
very easily and the main trouble is w. slipping off.

Make incision straight down over tib and tendon and
thru separate out some tissue etc. and part it (with
skin & m's & blood vessels) to either side.

In tying - split the ^{one} ~~two~~ tendons. Tie a knot in
one of them then split w. the other, split it and
tie it.

Use the more later. poster. of the soleus & plantaris
& get its tendon from way on plantar surface.

Tie all the cut m's back to the edge of the crips.

Use the tib. anter. & the lat. poster.

Cut the flex. hall. way down & then turn it up. Can tie
it to itself.

Tib. anter. goes down under the peroneal group &
the plantaris, comes over laterally to the long
dig. comm. tendon. Just two m's.

Clear long ends an tendons by clearing away m.

♂ #2 (17) Nov. 20, 1938 | Made ties w. tendon only, no

silk.

Ant. tibial to achilles tendon
Plantaris " ext. dig "

Cut all the other ms
except peroneals &
sutured them back to
m. & connect. tissue

Put tibial down under peroneals
and the plantaris (also lateral) above peroneals.

Made 3 incisions - one for tib. ant. tendon, one for plant. t.
and the regular lateral one.

Cut quite a few blood vessels & may have injured a couple
of nerves to the foot.

Nerves Separate ms to the gastroc. heads near origin - lift the
tibial nerve and they show up. Pull gastroc. & back after cutting
tendon &

Tib. ant. imis from below $\frac{3}{4}$ way up belly of m. can pull it way
up far as like.

Ext. dig. not quite as high up as tib. anterior.

Peroneals high up.

Sumner " , like other hallucis is attached all the way up.

Paste up a no. key for ear notches.
Make out cards for each operated rat.

Examine glottis reft. and make an instrument for cleaning trachea.

Examine nerve relations again and make sure all the extra muscles can be removed w/out breaking n.s. to used m.s. so long as the ~~m.s. crossed~~ m.s. left in retain their full n. supply then don't have to fear regenerat'g n.s. splicing things up.

All the m.s. can be removed nicely from lateral incision.

The soleus is simple to remove

" peroneals likewise - tho watch n. along

" gastroc. is a little more difficult - but can be done by going in anteriorly - after 1st cutting tendon posteriorly. Pull it out and cut it high. Watch the m.s. around it tho.

The flexors are more diffie. n.s. & stick to bone.

[Breathing seems to be easiest when rats' head is right side up.]

Watch the blood vessel near bone - upper tib. anter.
" " " " at ankle posterior in sewing
up after operation.

(.5 cc for a 250 gm. male seems to be good - it's the mice we have to watch.)

Make the injection w. needle up to hill so that some of it does not leak out.

Watch the ears before begining operation.

Cross tib to the calcaneus process or to the tough sheath of achillis T. surrounding the bone. - question of whether to get the tib. anter. tendon long enough so that can tie tendons or use silk.

Cross the Medial gastroc. to ext. dig. comm. - can use long tendons. Maybe can build a small ligament farther distal on the ankle ~~under~~ which the tendon can slide - or else just fasten tendon to the bone out a little ways -
- have to do something so tendon doesn't rub on bone - or sheath or articular effect.

Soleus m. goes in about center of belly - approaches from between gastrocnemii.

Peroneal n. goes just over origin of later. gastroc. have to go beyond it in cutting out the lateral. gastroc. When it comes down & puts peroneal group high up near origin - just across origin of soleus.

~~Per~~ Medial gastroc. OK. get as much tendon as possible. Tie to connect tissue just between ant. & ext. dig. tendon.

Peroneus longus m goes in way up at origin on inside.
Gastroc. get branches low down from sural

Possibility of transplanting m. entire. Put in new origin w. nerves & blood vessels trailing and then let the tendons at insertions regenerate themselves. (It's never been done.)

The anter. tib. & ext. dig. can be loosened and moved backward tow. later. gastroc. The nerves are long & can be loosened after removing peroneals, but the blood vessels to tibia are short up under origin close to bone and cannot be pulled very far.

All n's to tib. are high up - but a couple to ext. down in center of belly. & probably blood vessels w. these.

Lateral gastroc. gets a branch from sural low down.

" " w. blood vessels & n's can be stretched over to locality of anter. tibialis. Bl. v's & n's together here

The humil. exten. dig. under tib. can be pulled way over, but its origin has no tendon at all.

Soleus w. nerve can be moved very nicely over to tib. ant. point - possibly - the blood vessel, low down w'dn't be so easy to pull over.

Possibly tie ant. tib. to theiceps fascia to hold it in position & then let it form its own adhesions.

The medial gastroc. will go over posteriorly to ext. position, but not anteriorly unless send it between tibia & fibula wh. should be possible, after flex. long. dig. taken out.

Two n's to plantaris enter well down in center of belly from behind.

The plantaris can be stretched over, but it's a bit too far and the scratch reflex w'd pull on n's - maybe break 'em or the origin of m.

The medial gastroc. will come thru tib. & fib. bones & then nerve holds the muscle nicely in place. It's possible to come thru the bones close to tibia w/out cutting

May have to free sciatic for some distance to see it'll stretch better!

Can very easily - cut out all the extensors and transplant a soleus & plantaris or ~~tibialis~~ gastroc. to replace them. It will be a good test to determine whether or not the tendons will regenerate to strange n's & low origin will stick.

Bring med. gastroc. thru bones & leave in the small extensor. Leave the tendon sheaths intact down around ankle, prevent adhesions.

To put medial gastroc. in place of tibialis anterior.

1. Make incision as usual. - only not so far down. - or don't cut fascia so far down.
 2. Cut biceps fascia further up around knee.
 3. Cut out tib. & ext. o. - leave enough tendon above ligament so it doesn't go thru. - watch blood vessels under tibial - better cut in the m. and so leave a little around origin.
 4. Cut out flex. dig. longus so be more room for nerves of gastroc. & other flexors here.
 5. Prepare opening just under tibia for gastroc.
 6. Use plenty of Ringers & don't handle gastroc. any more than necessary.
 7. Clear around gastroc. - the n. comes in from behind, running under the femur +// w. it!
 8. Separate the gastroc. fr. other head.
 9. Up at top there is a fairly small origin - cut it. - can see n.s now - may be able to find main tibial from connect. tissue so it'll stretch farther.
 10. Pull prep. out w. glass hooks.
 11. " n's thru and place it w. the tendon side up & the cut fibers down toward bone. - place it up high as possible because gastroc. is long.
 12. Leave the origin to fascia about knee.
" part of it to the ext. dig. tendon up there.
- { Use rat-tendon sutures }
- 10 1/2 Watch the blood vessels that go to m. close to origin - be careful in cutting origin - split rest of gastroc. away after cutting origin.

In crossing, cut out the fibula. It makes a better set-up for the tib. ant. & the exten. in pulling on the achilles - almost puts them in a plantar-flexor position.

In cutting out gastroc. med. cut way up near the bone or will cut blood vessels. And separate it from rest of gastroc. from origin end down. It separates easily at origin.

In free transplant of gastroc. med. clear interosseous space as high up as possible. This will cause less stretch on the n. if its drawn up at highest possible position.

- Not much chance of getting more slack on tibial nerve.

No advantage in bringing tib. ant. thru interosseous space.

Soleus will go over.

Tib. ant. & exten. will go over - cut out bone also?

Possibility of free transplant of gastroc. lat. w'out stretching n.?

Can bring tib. ant. & exten. long. dig. back w'out their blood vessels to the origin of plantaris and lat. g. very nicely. - leave some of plantaris t. to tie to.

Question of how to leave tendons of tib. & ext. - cut short & let 'em dangle or put in thru achilles tendon.

Don't know whether healing would take up slack or not.
(Maybe better try both methods)

In free transplant of ext. & tib., leave the peroneal longus in, w' its nerve cut, to hold the ext.s in flex. position.

Free transplant - double.

M. gastroc → tib ant

Tib ant. & ext → lat. gastroc.

Leave in soleus & plantaris & their n.s.

Do tib a-ext transplant 1st - cutting out l. gas. & peroneals
(except tongue) Clear interosseus membrane so can see
tibial peron. n. to the m.s.

Careful in clearing away l. gast. from soleus & plantaris n.s.

Cut triceps fem. far to midline so have plenty to sew over
trans & m.s.

Cut l. gast. long so have its origin to fasten to 9 & ex's.

Get a rubber bulb for aspir.

Get all equipment etc. this quarter so be ready for next
semester. = "mic" etc.

Make more Ringers

Use autopsied rats to collect n. tubes & tendons.

Make use of fascia to guide regenerating tendons.

Got to leave in the peroneals that spread the
toes. ? of whether it's peroneals or flexors or just
the m.s. of the foot & so a matter of keeping the
nerves to lower foot intact.

From 1st autopsy - muscle transplantation looks
possible - if can keep the muscle belly in good condition.
Will have to take extra care against infection.

Leave the tendon ends long where m. is to be located -
don't cut the skin down over the ankle - have to cut
out extra m.s. some other way.

Can use flock of young rats - tend to cross on in complex
& leave in a long time & compensation growth of
young m.s.

Mark net. & exact age of rats on cards.

Use the lat. gastroc. for dorsal flexion rather than medial
because the angle is better.

Note how far up an nail the 10% Na An. solution
comes so can fill up if spill in mixing.

Can cut out the peroneal & ^{inside} flexor group alright
w/out destroying spread of foot. Spread of foot
evidently depends on flexor m.s. of digits and so
nerves to these must not be cut. These m.s. are
supplied by the plantar n.s. which come off tibial
and go down over soleus & plantaris m.s. to the plantar
surface of the foot.

The soleus n. to tib. anter. & the tib. ant. nerve to
plantaris

In sewing to heel approach w. needle from rear so
get more slant.

In front go in longitudinally bring med.
gastroc. tendon along also & anchor the
whole thing so will heal quickly.



Try crossing plantaris medially - after the fibula bone has been removed. May be able to tie it to the ext. comm tendons after they divide and go to the various toes.

Need a very long tendon for plantaris muscle if it is to reach dorsal surface of foot.



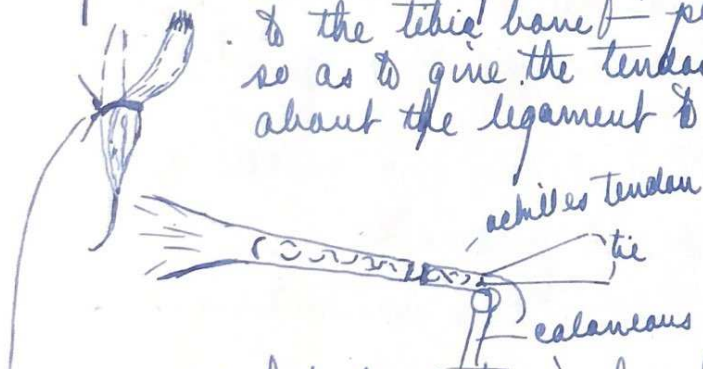
The free transplants don't work so well, because muscle atrophies and the chances of infection are increased about 75%.

The cross of tib. ant & ext to achilles tendon is good. The problem now is getting an opposing cross for dorsal flexion.

Tie the biceps femoris, near its ventral border, across to the fascia of tib. ant. This will cause horizontal pull and possibly prevent a ventral downgrowth of m & connective tissue to the calcaneus process.

The lateral gastroc. can be pulled farther anterior by sewing its fascia to the tib. ant. fascia.

Possibly a sort of ligament arrangement could be worked out so that the lateral gastroc. would pull directly up. Could use a piece of tendon to make a loop and tie it to the tibia bone - perhaps chipping the bone at the side so as to give the tendon a hold and to cause ossification about the ligament to hold it.



(Another method that might be used in tying the tendons)

What about tying the lat. gastroc. to the tiny extensor tendon under ta & ext? might scrape it then so it'd grow larger.
 In making ligament, tie a loop around m. first then tie tightly to bone



Problem of a food bowl:

Have an inclined plane at the base of it so it'll be easier to see the plantar flexion of the foot.



Try out some temporary arrangement at first to see if it's going to work - if m's are strong enough to lift body etc.

Have to have something they can't climb up on top of - can't have food down too far in container or they'll double-up & climb up to it.

!! How about using water instead of food - trouble is that they'll not go for water as often as for food.

Might make the tube very small so they'll either have to go oftener or else stay up there longer.

Use flat board or glass below water then have to have only a single surfaced plane

Have something to attract their attention to the water.

Make the water pipe of metal or of very thick glass if possible so that they can't chew it off.

Might make a food container that they can get only their head in — thus have ~~straight~~ planes at base.

Get a large high cage with a long series of compartments in it. Make compartments fairly large so can keep several animals of same height in same compartment.



Small needles — insect needles ground a flat cutting edge
on the tips — celloidin or something to hold tips
— how about a nick in top of tie the thread.



There is a small nerve that runs down along small extensor
brevis (wh. gives a small shoot to tib. ant. low down^(?)) wait
stretch it if pull tib. ant. toward calcaneus, apt to break
the nerve just pulling out the sm. ext. brevis.

N.s. to t.a. & ext. com both high, but not thoroughly protected
by bone — so be careful in separating interosseous membrane in
upper $\frac{1}{4}$.

Plantaris and later. gast. are equally good — both have
same origin.

Gastrod. is a slightly heavier m. and the tendon is
thicker so better that way. But it's a question of which
can be gotten w. its nerves most easily.

The nerves enter lateral g. right where its connected to
the plantaris and med. gastroc. — quite a mess there and
will require more dissection, under mic.

The fibers of later. g. are curved just right for the trans &
position.

Tendon grows to dorsal surface of foot O.K. — not a clean
attachment but general sheathing and piling up of
connective tissue.

Nerves & blood vessels to lateral gastroc. & plantaris m.s. !!!

much more likely that biceps femoris will grow down than medial muscles.

if want to expose later gastroc. & sciatic nerve better can cut up from knee just over the femur main nerve to foot down between gastroc. & and right along with it the nerve to internal flexors runs down to upper $\frac{1}{3}$ of muscle.

lateral gastroc. has a red and a white head (posterior) nerve to lateral head enters between white head of gastroc. and the plantaris.

Parts of femoral go down head also right in sheath between plantaris & gast.

The nerve comes in from behind so that if rip out plantaris will rip out the nerves to l. g. as well. Soleus nerve runs down here also lateral to plantaris between plant. & gast.

Branches of femoral also innervate gastroc. soleus. & plantaris.

Both femoral & sciatic branch close together just above flexor group.

All the nerves to the ^{coming in from behind} plantaris enter it from the lateral anterior side - can lift plantaris and as work up it cut the nerves to it - one by one leaving them to lat. gastroc.

It's possible to separate the white head from rest of gast. start dorsal & later & working fibers apart, not cutting deep to nerve beneath.

The two nerves to lat. gastroc. come in together.

The l. gastroc. can be pulled up over peroneal - had better be - but watch stretching of the nerve in process.

A nerve right under peroneus longus. 1st to branch off main peroneal.

Peroneus long. is innervated by small branches later, short,

nerve to extensor com. about $\frac{1}{2}$ way down.
a nerve runs down under tibia next to bone. (tibia)

In separating interosseous membrane — run along
the fibula bone and start well distal
I always clear the fibula well before lifting it out.

In incision — leave the fascia over the tib. ant.
as intact as possible — go in from the side.

The nerves to plantaris enter ^{on} anterior face right along tibia
n. to foot.

Split plantaris off right along tendon laterally. — don't
have to remove upper portion of it.

In removing ~~tendon~~ white head of l. gastroc. work
from origin down — clearing away laterally 1st, the
nerves being medial to g. m. Nerves & blood vessels
both run into lat. g. along med. surface of white head.

Can lift l. g. over the peroneal n. OK.

Can get med. gastroc. out from lateral side OK.

In breaking out fibula push medially.

All m.'s can be removed from lateral side.

Right under tib. ant. is a long tendon that pulls toes
up. & muscle is not very strong so can use it

The tendon goes to 3 center toes.

Can use the small one to the big toes cut the tib.
anterior right beside it & scrape it of little then maybe
it'll grow larger.

Leave the top of plantaris sticking to the gastroc.
then ~~saw it to the~~ ^{tendon, not muscle} cut plantaris tendon and sew
it to the fascia over tib. ant.

~~scrape~~ scrape the ~~muscles~~ ~~muscles~~ ~~muscles~~ so it'll thicken.
It'll be a mere thread in the young rats.

Sew in the thread before cutting the tendons.

Free the tibialis m. way up along bone and along peroneal sheath, then it pulls away down out of way.

The lateral gastroc. & tib. ant. & ext.s can be done all from a lateral incision.

2 Problems = ties of tendons.

1. Split lat. g. tendon well down & sew into rest of achilles. Sew tib. ant. tendon to

2. Sew up some tendon of exten. group so it'll hold then sew down gastroc.

Should be able to cut t.a. tendon short using the med. g. tendon to tie to ta & ext.

Perhaps tib. tendon then will regenerate to the later. gastroc.

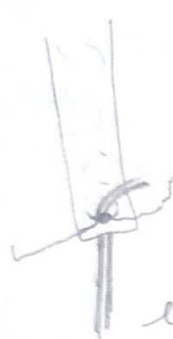
might tie the ext. tendons and then tie later. gast. to that knot.
try tying the later. g. in place & letting the tendons regenerate.

Put the extensor tendons thru g. tendon, then tie a knot and sew them together.



- 1) Have to sew thru the ext. & t.a. 1st, then let hang.
- 2) Then in dorsal flexion sew together the gast. & ext. tendons so that they will still be loose. Tie firmly.
- 3) Sew t.a. to achilles fairly tight.
- 4) Tighten up on the gast. by sewing origin to knee fascia.

Sew down thru g. 1st leaving threads loose. Then bring ext. tendons thru a slit. Tie threads to ext. tendons at the base. Then tie above.



tie around ^{ext.} tendons then make knot in ext. tis.

Make have to tie around ext. tendons to thread them thru the g. tendon.

Leave g. loose & let it atrophy a bit it's too large a m. anyway. Pull medial side of peroneal sheath up over t.a. & ext. cannon & sew to skin over tibia.

Avoid breaking blood vessels to lat. g. when separating white head if possible.

Watch b.l.'s around achilles tendon & nerves here also.

Have to sew later. gastroc. over into a more anterior position otherwise tendons are sure to form up to it from calcaneus.

In tying the ext. tendon to the lat. gastroc. m. split g. tendon & bring just thru as above. Then tie the ext tendon at desired length by knotting it w. silk used on gastroc. In tying the knot - knot the two tendons, each tendon and silk, etc. till up length, then tie final knots of silk to silk to hold whole knot together.

Make some small needles - hammer end flat, then curve it up at sides & glue a piece of thread to it. Then sew in the ext. tendon.

In connections between tendons always split the larger and bring smaller thru to over-lap.

In removing the flexor & peroneal groups of m's always cut up the fascia longit. by first.

The nerves from soleus and t.a. can be crossed quite easily - I hope. May want to use extens. nerve rather than t.a.. Diff't m.s. to the m.s. used.

Make incision more laterally than have been and cauterize the large superficial bl. v. Then be careful in sewing up not to cut thru it.

Fix up a sling to test reflexes - try crossed extensor reflex.

Test flexion reflex w. just the gastroc. now in to see if it also contracts. If just one muscle would do the flexion. Try making a single cross-over anteriorly. to see if can get ext. reflex.

Nerve cross the soleus n. runs over surface of the plantaris laterally among the fibers of the lat. gastroc. then dips medially to t.a. Can have the symp. n's to med. gastroc. that come in w. blood vessels.

More difficult to preserve nerves blood v's to the t.a. - can be done by cutting the nerves some distance from the muscle.

Cut the peroneal n.s. close to the main branch, otherwise apt to get them mixed up w. the n's to t.a.

Nerve cross - in freeing soleus nerve. Set posterior and medial to wk. head of later. gastroc. as soon as possible. Do free it from plantaris, later, cut the muscle off as close to the nerve as can get, then pull thru from other side.

In freeing t.a. nerve. - use microscope - there is a nerve to foot running along peroneals and another under the exten. capm. - both of these can be retained and pulled posteriorly with the main branch.

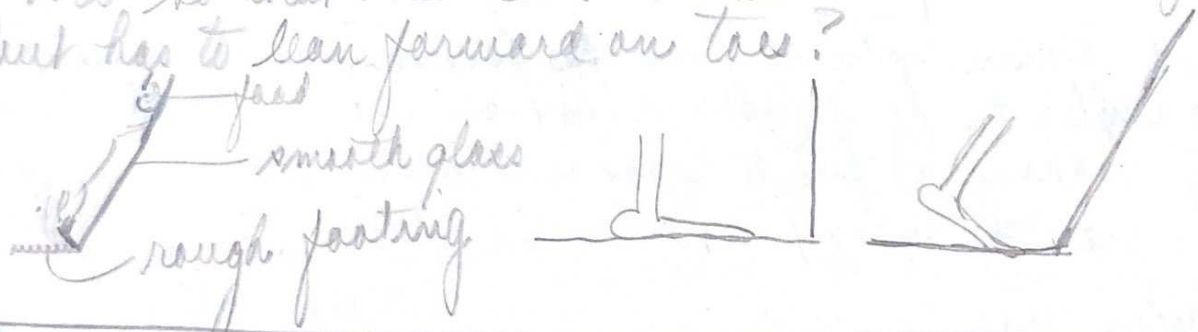
There are several (symp.?) branches that go down to extensor group from near origin of peroneals and these can be saved if work carefully.

The ext. capm. nerve is larger than t.a. and can be used instead or with t.a.

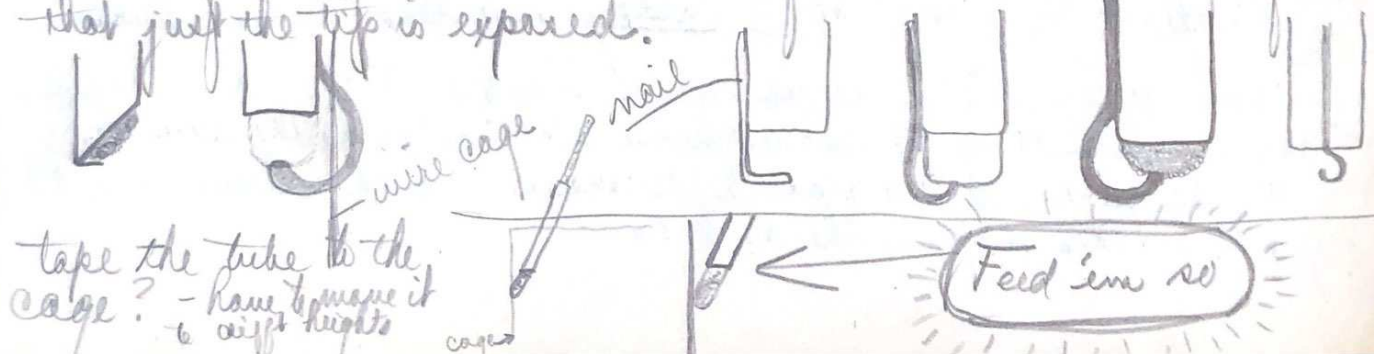
Matter of freeing the diff. branches up near origin from symp. fibers & then pulling in all over.

There are two branches to med. gastroc. & a cm or so can be cut from both of 'em.

How about sloping the glass wall under the food & Nes so that rat can't balance back on heels but has to lean forward on toes?



For feeding: metal tubes to fit around the hard food so that just the tip is exposed.



Can remove peroneals in later operations if want to.

Swimming Reaction is quite distinctive in the ~~too~~ operated and unoperated animals.

They have tub of water filled to 2 or 3 inches with a ^{smooth} dome in the center. The R's in attempting to climb up sides & maintain position on top should be quite characteristic!

What about some soft - cheap ^{absorbent} mat that can be cut to proper size and put in bottoms of cages so they'll not injure heels in walking about.

make a list of the rats - their operation date & date of 1st use of operated muscles. dorsi-flexion and plantar-flexion. Then in a list have the different reactions which are being tested & grade them ABCDEF

	Op	2	3	4	5	6	7	8
Date	A	B	D	C				

Test them once a week at least.

each animal.

Have a separate card for

Keep the small cards w. the details of the operation on it date etc. wh. fill out just after the operation reverse one side for each leg.

Then have the large ~~card~~ ^{sheet} w. dates & R's & which leg being tested.

And also a large card on which make general descriptive & summary remarks.

Try training these rats for rest of quarter and then use 5 of them for additional operations after have some practise in crossing nerves.

Try this quarter to get some nerve-crosses. & cat muscle-crosses.

#10 1. Cutting the nerves to crossed n's on rat w. foot partially ankylosed caused disappearance of that amount of reversed mant. that was previously observable.

#15 2) Cutting the tendons of crossed n's also causes disappearance of reversed mant.

For nerve-cross-dissection

In getting at soleus m. - cut plantaris & lat. gastroc. at origin - fold back & can see nerves as enter the m.'s separate plant from lat. gas. & then sol. m.
Cut the plantaris m. just above m. & slide it out from below.

The post. lat. super. n. gives a branch to lat. gastroc. & one to soleus.

2 branches of sciatic into med. g. & a third from along blood vessel. All enter fairly close together near origin.

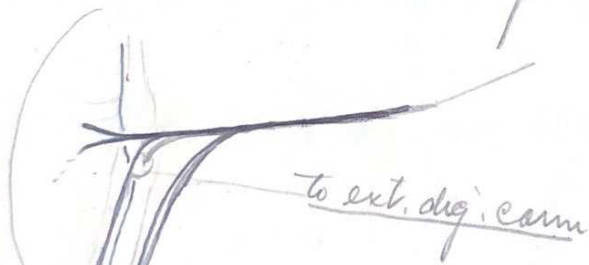
The large bl. v. under deep flexors runs in interosseous membrane before entering t.a.

Can't go in on medial side very well - muscles been using are best - and it's a question of getting a map of the n.'s to and about the t.a. so can go in and bring 'em back to m. gastroc. - can insert in ant. border of med. gastroc.

Peroneal is originated from anter. side of condyle.

Free sciatic back away - loosens stretch on soleus m.

The peroneals cross above these from above knee



can free it - may injure but will regenerate.

under peroneals starts off well lateral in peroneal then goes to medial side (lateral & anterior below)

Procedure for nerve-cross.

Cut well anterior in 1st incision.

① Go in medially and remove all the deep flexors. pull skin back & leave that side for good.

② Come back laterally & open-up biceps - fold it back.

③ Cut out lat. g. and plantaris free the soleus m. leaving a chunk of m. at end of it - pull this m. back out of the way under the biceps flap and leave it till later.

④ Work under microscope - remove the peroneal group leaving n's intact & the ext. comm. Keeping the main n. to extensor comm. intact w. a small piece of m. attached.

Free the n. up all the way down to foot and drag it all back & insert ends into med. gash. insert soleus m. into t.a. high up - loosen tibial nerve back posteriorly.

Sew b. femoris very loosely to tibial sheath - when do double nerve cross.

Danger of regeneration

No danger as far as tibial anter goes - all the original nerves are dragged far away from it
(femoralis might grow into it)

There is a chance of the old plantar flexor n's growing back into the med. gastroc., however,

- ① The orig n's to med. g. are right there in position.
- ② The plantaris n's & the lat. g. n's are also right there ready to grow in.

How prevent the cut plantar flexor n's from growing into the med. gastroc.?

May have to use 2 operations.

The nerves to med. gastroc. can be pulled loose from main tibial trunk for quite a distance back and cut back there to prevent regeneration - might tie a knot in the end.

The peroneal n. and branches can be separated rather cleanly - by leaving the fibula in, cutting out the per. loughs first and so on working medially one by one and clearing them out to the origin completely.

The procedure across - makes a satisfactory order of steps to work in.

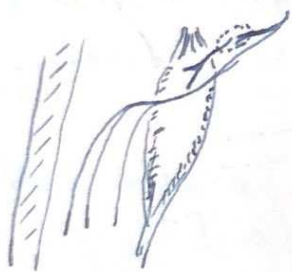
Watch the n's to plant. & lat. gastroc. see if can do something with em - cauterize or something. Crush for some distance.

Try a control or several with one single nerve cross
the solus nerve into the tib ant. — Then leave in just the
medial gastroc. w. its orig. innervation. It will cause
contraction to prevent ankylosis & keep the t.a. in good
condition.

Then: accordg to resonance notion the tib should
modul. the nerve and there should be good coordin.
otherwise there'll be a sort of contracture between
the two opposing m.'s. Have to watch the behavior
before & after innervation.

Try a few smaller rats with the single and double
nerve cross. Have got to get some successful
nerve crosses to compare with the muscle-crosses.

Can cut the nerve to medial gastroc. high up and
suture it to the t.a. nerve.



That would leave only peroneal, l. gastroc.,
and plantaris & deep flexor nerves to regenerate
into the gastroc. medial.

Don't sew flaps back over tibial except low down
to prevent growth to the calcaneus process. If do,
leaves a space where blood collects and hardens in a
large clot.

What about leaving in the tibialis posterior and the deep flexors.

Probably couldn't leave the n's to these. - Could leave the m. to deep flexors if can locate it. but probably could not leave the nerve to the tibialis posterior.

All of these medial muscles are innervated by a branch of the tibial nerve that comes off the main trunk just after the branches to gastroc. med. & plantaris & gas. lateral - right about level of main branch down thru the calf of the leg.

So - do it in two operations - 1st crossing the n's & 2nd cutting out medial muscles!

Die the n's if they won't regenerate, even leave 'em loose & they probably won't get thru the perimysium

Be careful not to cut nerve to biceps femoris in about $\frac{1}{4}$ in + from t.a. sheath.

Use larger rats to perfect the operation, then work down doing younger and younger ~~and younger~~ ones until get some successful operations.

— So find out how young they have to be operated on to get successful n. crosses. Then, make muscle-crosses of the same age and compare them.

Nerve-cross operation:

- 1) Lateral incision at edge of tibial muscle.
- 2) Fold back biceps femoris - (don't denervate.)
- * 3) Free soleus n. - cutting out plant., gas. lat., & soleus, tying the extra nerve-endings.
- * 4) Remove peroneals cutting the fascia away with them.
- ? 5) " Ext. comm. & ext. hallucis keeping the nerve to ext. comm.
- * 6) Free the peroneal n. & branches, cutting these to t.a.
- 7) Cut and tie the n.'s to gas. med. (w/out injury to ul. n's)
- 8) Insert n.'s into m.'s near motor points.

Question of whether to use ext. comm. instead of t.a.?
objection is that the motor point is low down on the belly - would stretch the soleus n. & there may be a branch of peroneal sup. beyond point of branch to ext.
would be easy to cut t.a. tendon & put it into the extensor tendon of muscle.
It might save breaking blood vessels, - stretching soleus nerve.

I Brain about 4 n-crosses w. all the centrals mixed in. Use 4 cages and distribute according to size.

II Take the other three animals and pull out the peroneal longus muscle in at least two of them.

Consider various other operations along w. the first - such as cutting nerves to the various m's & pinning knee, etc.

[muscle & nerve cross in one] after get successful n-crosses.

Set between bic. fem. & gastroc. distally $\frac{3}{4}$ way down.

Try to get soleus n. into ext. comm. instead of t.a.

Put soleus n. into ext. comm.

After removing peroneals & sheath on posterior face of ext. comm., tie off the n's that don't go to ext. comm., halber, or tibial out. Then lift the peroneal about on thread till have the endings inserted in the med. gastroc.

question of whether to leave in deep flexors or not, they don't seem to help much.

Insert into gastroc. right along old nerve. & try to do same for ext. comm.!

Cat Dissection

The tibial, peroneal, sural n's are all as in rat.

The medial superficial n. comes down slant-wise across the ankle tendons.

The ligament under wh. t. & ext. tendons go is higher. & it is attached to the fibula distally. Have to leave part of fibula in.

The peroneal can be removed or slid under.

The extensor comm. m. could easily be put into med. gastroc.

The ext. comm. tendon - can be sewn thru to meet gastroc. after pulling it down & freeing it from ligament.

The tibialis tendon can be cut down pretty low as in rat to get good connection w. achilles tendon.

Some of peroneals have slid quite a ways up under the tibial m.

Same cross-later gastroc. over is best - pull it up from under the peroneal.

Superficial flexors are small and not as numerous.

Plantaris?

Small n's from lower tibial into soleus m. Soleus is attached - fleshy along fibula

Superficial n. & blood vessel cross over from post. to ant. just above ankle. - cut it near ankle.

Origin of soleus is up under peroneal nerve.

The sileus n. can be stretched, just barely, to the t.a.

Peroneals cause dorsal flexion so remove 'em. all 2nd one under - long, thin makes only outside toe x

Sileus n. has both peroneal & tibial n's close to its origin.

Cut the branch of n. superf. peron. down near ankle where it branches backward.

Have to cut down on dorsal surface of ankle quite a ways - there are two ligaments

Rare achilles tendon from medial side.

Leave the two ends of the fibula in - remove only center $\frac{3}{4}$ of the bone.

After fibula removed, can remove deep flexors under it fairly easily.

The med. gastroc. can be separated from medial side & then reattached by cutting tendon & pulling up on it from the origin - between n's & blood vessels and putting off.

The plantaris can be separated out the same way - it's large, between 2 gastroc.

Cut plantaris tendon high.

Nerve to lat gastroc } comes in fairly laterally -
be careful not to cut it } when freeing plantaris!

free nerve under t a only small dist. distally, cause blood vessel enters m. there.

Cut the later. gastroc. tendon as long as possible.

Make ext's pretty tight to achilles.

Use plantaris tendon to join with the ta. and don't cut it any longer if necessary.

Can easily cut off the extra muscle below the 1st ligament.

A lot of pull comes on achilles t.

Part of gastroc lat. has origin on fascia in common w. biceps fem. on level w. patellar tendon.

Biceps femoris has a definite tendon down behind g's. have to free it & turn it side-ways.

For freeing deep flexors look posterior to fibula at distal end.

★ Leave the tendon sheath far up the ext. comm. Then by cutting gastroc. very low the two will come together.

Will have to sew high up in the tib. anterior. and the ext. comm. in order to make them tight enough.

Don't have to make incision below the more distal ligament. Can cut tibial tendon there. The force will come on ta. so make it tight.

Keep plantaris tendon & sew to it.

1. Lateral incision - cauterize b.l.v.
2. Free biceps fem. up over knee
3. Remove soleus m.
4. Remove peroneals
5. " " fibula
6. " " deep flexors.
7. Free plantaris from g.
 - Start by separating from medial gastroc.
 - Then from lateral distally & work up.
 - Cut at origin by deflecting anteriorly across knee.
 - (+ cutting n's to it 1st.)
8. Being careful of lat. g. nerve, file medial from lateral
There's a sheath running between the two.

9. Remove medial gastroc.

Put it up under nerves.

Large blood vessel here
no vessels under knee

Deflect it posteriorly - put scalpel in behind it then.

Deflect it anteriorly across scalpel (or scissors) & cut.

10. Free ext.s and watch n. under tibial.
11. Free tib. from bone & sheath.
12. Sew into ext. c. tendon distally from point a bit distal of center point between the two ligaments & cut the tendon.
13. Cut tibial. tend. well down & sew ext & tib. together (1st gaging distance to achilles).
14. Sew into plantaris - cut gastroc. low down - include a strip of other tendon to make it long & sew above junction to ensure strength.

Free the achilles n's from bottom up - and
don't take white head of g. w. med. gastroc.

Upper fibula is attached to tendons - probably best
to clip it off as far up as possible, but not break off
head!

See if can sew ext. carn. tendon to tib tendon
below where cut the tib. tendon.

#1 300 gms - injected 3 cc (.2 + 1) = too deep an anesthetic
better to inject less and wait longer before operating.
Injected 1 cc of phys. saline after got under 5 hours and still
very lumpy.

Will have to pull the proximal nerve and
blood vessels over with the lateral gastroc. cut
the nerves & blood vessels about $\frac{2}{3}$ of way
toward foot.

— Damn Cats!

Rat cutting nerves of hip & knee region

Pectus fem. - femoral nerve.

Vastus lat. - " "

" med - " "

" interned - " "

Gracilis a - obturator n.

" p - " "

Adduct l - " "

" mag - " "

" brevis - " "

Pectineus - femoral n.

Sartorius - } gluteal n.

Tensor - }

Glut. max - }

Piriformis - a branch from l. sacral plexus

Obturator internus - " " "

Gemelli - " " "

Semitendinosus - main head by tibial +)

" membran. - tibial

Coraco femoral - " many n's.

Saphenous comes off femorals-poster. div
Sural " " sciatic

Arteries & veins run wild all over the place
a lot of mass at hip joint in the rat.



Pat. muscle cross - In freeing medial gastroc.
cut the lat. g. tendon first, then cut med. g. tendon and
flap both of in back so can see the nerve insertion.
Be careful of blood vessels to the t.a. in cutting out
the deep flexors.

Use the ext. comm. in nerve cross. Tie off all the
nerve branches that don't go to t.a. or ext. comm. then
can insert all free ends into med. gastroc.

What about putting deep flexor nerves into ext. comm.
no, don't know for sure when they work. Besides,
the function of t.a. comes back more easily than
med. gastroc.

* Be sure to pull the base of biceps femoris across
the shank. And try not to tear or cut thru any of
the m. fibers on the distal edge or sure as
shootin' they'll proliferate down to the achilles
and form tendon.

* Also be careful not to injure posterior edge
of the lateral gastroc. because accessory
tendons will form to the achilles.

Try removing the per. long. - It will speed
up the operations.

Use the peroneal sheath some way to wall off
the two n's from each other.

The per. long. does cause dorsi-flexion slightly.

1/2 do -

find where nerve enters distal end of biceps fem.
and cut it.

find a sheath that can replace the peroneal
ligaments.

Autopsy all the old muscle-crosses before starting
a new batch.

Work on nerve-crosses now going to younger &
younger animals.

The later gastroc. seems to do O.K. right up under
skin - how about sewing the tibial sheath over
to biceps femoris tightly to separate gastroc. from
tra.

Rat nerve cross.

Use the tibial m. rather than ext. comm. - can slit tibial
tendon and tie ext. comm. to it if like

Leave as many nerves to foot as can, but those that have to
be cut tie off first - can ligate thread to handle nerve with.

Use the cut branches to anchor the peroneal after its insertion
into med. gastroc.

In freeing origins of peroneals, pull the insertion under and
proximal to the peroneal nerve.

Make insertion medial so can remove deep flexors
easily.

The sciatic nerve can be freed by digging from distal to
proximal, it travels in a little tunnel.

Tie off extraneous branches close to main trunk. Leave the
two threads on one branch close to the tib. and ext. c. n's
to tie to med. gastroc. to anchor in place. - make a very
small knot thru fascia or fat or something - or thru the
distal end of the orig. gas. med. nerve. - I have to be careful
doing that or stray branches will ender - I'd use the proximal
end of the nerve tho.

Can anchor to deep flexor n's - ? as to whether there are additional sensory n's in the trunk that it would be better not to have severed.

Better find out what the situation is with the deep flexor n's - whether they can be tied to or not. Also find out how those n's pull back there.

Remember - can use plantaris and later. gastroc n's to put into t.a. if cut the solus. Have to pull the peroneal anteriorly and anchor it to fibula w. the deep flexor n's.

OK to tie off the lower deep flexors - but leave the upper branch to knee n. & watch don't cut 'em all when remove solus - go over its origin.

The last branch of peroneal to foot can be separated back quite a ways from the ext. & tr. trunk so that the t.a. n's need not be cut so close to the n. and \therefore the blood n's to t.a. can be left intact.

The solus n. can be pulled away from trunk and all the rest of the nerves there tied off. Rat. g. & plantaris.

By thus cutting the deep peroneal branch to foot, am cutting the n's to the dorsal n's of the foot, but in leaving the plantar n's OK. leave the n's to the plantar surface of the foot.

M. Cross in thigh

Use cano. femoralis and the deep posterior-most sartorius.

Lift up the lateral portion of gluteal m. & loop c.-f. under it.

Use tendon of deepest sartorius to tie to.

Leave long tendon sheet distally on medial b.-f.

Can use lat. head of b.-f. as tendon for sartorius, flapping it back medially. Cut it off early, long

Blood vessel super. along post. aspect of leg - running thru b.-f. trig. near gluteal.

Remove lat. b.-f. first of all.

May have to cut the sup. muscles & n's. — the poster. one is the one that crosses lateral over ankle & is cut anyway.

Remove part of medial gluteal. Have to slide c.-f. under anter. gluteal it's so long.

Going to be diffic. to get long enough head tendon on sartorius.

Go in laterally and prepare cano. femoralis for cross. Then clear away laterally as far as possible & go in medially later. Prepare sartorius last of all!

What tissue use to enclose the two nerve crosses:
Should be able to run off a bunch of these " " in
short time.

How about peritoneal membrane? or some other rat
tissue? Can't be connective tissue.

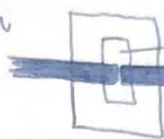
Bladder might be O.K. Any dead tissue. Veins.

Allantoic membrane commercially prepared.

Peroneal-tibial nerve cross:

- 1) Incision just under & // to femur, well back & well forward over knee.
- 2) Free biceps femur. along dorsal border and anterior border
- 3) Cauterize the n's & blood vessels to biceps fem. and free the two n. branches.
- 4) Separate the per. & tibial as far proximally as possible. and then make the transections well proximally leaving only enough length to cross over & lie well if all. m
- 5) Leave the distal branches as is and cross the proximal stumps.
- 6) Cross the central peroneal stump underneath to tibial & then the central tibial over to peroneal.
- 7) Cut the two n's approximately at same pt as they lie normally side by side, but cut the tibial branch slightly more distal than the peroneal.
- 8) Lay a piece of allant. membrane down, then bring the nerve ends together on top of it. Fold the allant. memb. over once making it around the nerve closely, then bring the other fold over, also tight to nerve.
- 9) Lay another down and do same for other junction.
- 9) Press the two cut ends close together till they begin to stick.

What about using collodion to stick n's



wrap first, then stick w. collodion & wrap second before it dries.

collodion no good

5^m of peroneal & tibial branches of sciatic produce excellent dorsiflexion & plantar flexion respectively. Have to be careful of anti-dramic impulses jumping branches and producing what look like axonal reflexes.

Cross the nerves after the n's have been crossed. & cross just those nerves that go to the lat. gastroc. and to the ext comm. & tibial.

The peroneal is still in there and may have to be removed.

Any old m-crosses that didn't work out so well? no.

M. cross leaving all the other m's in.

Free lateral gastroc. way down to get long tendon
take white head with & remove later. Be careful of
lateral gastroc. nerves.

Remove fibula. Free tibial, w/ ^{pirisly} long tendon.
Go underneath all the peroneals.

Free tib. way up anteriorly & posteriorly both.

Be careful not to break ext. com. n. when
pull it up over tib. can free

cut lat. gastroc. cut plantaris tendon when

* " " " " " soleus m. in freeing lat.
gastroc.

The soleus is attached above fibula so can pull out
fibula by the head.

Nerve Cross by Suture

Remove lat. gastroc. & plantaris & solus dissecting out their nerves.

Dissect back med. gastroc. n. far as possible.

Remove peroneals cutting & tying the nerves to 'em that come off ^{upper} common peroneal branch.

Dissect back the t.a. branch as far as possible.
" " " ext. comm. " " " " " "

Decide whether can bring both t.a. & ext. comm. branches over to lat. gastroc. or just the ext. comm.

Try splitting artery longit. and tying it, then tying the whole thing in place.

Be sure that the nerves lie end to end w. plenty of slack.

Try to over-supply the m's w. fibers

Be careful of blood supply to t.a.

Remove ext. pop. br.

Leave in deep flexors & dig in out several weeks later.

Nerve-Cross Preceding Muscle-Cross

Incision $\frac{1}{2}$ way down shank.

Clean peroneal nerve well.

Clear away the two gastroc n.s for crossing.

Put two g.s into ta. & ext. comp.

Put ta & ext. comp. n.s into just the later. gastroc.

Remove per. long. & pull its nerve out as far as possible

Pull sup. per. branch way back.

Do same for the deep per. branch leaving just the ta. & ext. comp. muscle supply.

Possibly young rats work better because nerve ^{branches} will probably separate more easily.

Free two gastroc. — don't free the med. g. very far — it doesn't have to be.

Just pull out the super. per. & leave deep per.

When crossing a large & a small n. pull large one way then & mash up the end of it — then insert the smaller one into the mashed mass. (ligateⁿ in the artery sheath)

Amputation of forelimbs

- ④ Cut thru m's high in upper arm. & pull out rest of bone to shoulder joint.
- ① Make anal incision around upper arm.
- ③ Cauterize large artery running w. nerves on medial side of arm.
- ② Pull m's out & cut em sharp.
- ⑤ Sew m's across first, then skin

Possible Problems

+ resect 5' infra.

See if m's and n's are qualitatively different - by regen. rate, preference,
1) Insert orig. of foreign n's into any muscle. Choose
m's of varying opposition. shape, robust, & width of nerve. Label a nerve to foreign
& orig. n's & see if it takes place
first.

2) Cut off motor, then sensory, then both in young
amphibians to see which inhibits cerebellum growth.

3) See if in ① there is a greater effect, differentiation
in very young than in old animals.

4) Cross the peroneal and tibial branches in rats of various
ages and see if there is learning in the old rats. If not
go down to younger stages and see if there is a point
at which relearning occurs. 10 day olds - no reap.

This will bolster the muscle-cross exp'ts in showing
that there is no learning, and if it appears in younger
animals, can suspect it's due to modulation.

5) If peroneal-tibial crosses are successful - cross the m's
left an.

6) Maybe can get m. crosses just after n. cross regeneration, to
work correctly and then gradually get manipulated into
reverse. - ~~Label~~ thing to try for.

7) Cut out m's and later examine cord for clusters of
deg'd cells to see what location/muscle is over the centers

8) The whole business of axonal reflexes after regeneration.

9) Cross n's or m's and leave all the other n's in so that have cases comparable to literature. Then remove other n's after several months & see if learning has occurred.

10) Cross n's in baby opossums

11) Cross a couple purely sensory n's and study location of learning. Couple up back of leg. Get differential R's 1st

12) Insert a sensory n. or a motor n. into a mixed branch & see how most of fibers go. (Try cranial n's)
pure sensory → sensory to skin
motor n. → motor m. In peripheral end use both living and cut nerves -
See if there's inclination toward selective outgrowth.

13) Amputate forelimbs on control & n-crossed & m-crossed rats & see if Beth's readjustments will appear

14) Do nerve crosses on reptiles, and birds. Anim. behavior

15) Try femoral-obturator cross.

16) Try phrenic into one muscle & see if pulsations ever stop. Get a m. whose contric can be easily observed.

17. Stain living nerves ^{to single up} or infect them or something & then study location of neurons in sp. cord.
-
- * 18. Cross obturator & femoral nerve 1st cutting out m's not innervated by it. Then make m-cross in shank.
-
19. Can get very long stretches of nerve either pure motor or pure sensory by breaking open the vertebrae in lumbar region. // for one neuron reflex, etc.
-
20. Can suture the sensory roots to motor roots very easily in the cord. Get single reflex units of a more general nature.
-
21. Suture the dorsal roots from one leg over to contralateral dorsal roots and see what happens to the coordination — can probably take a whole bunch of roots at a time in a large (dorsal aorta or allantoic memb.) sheath.
-
22. Split the spinal cord longitudinally thru hind limb centers & see what happens.
-
23. Expose cord of a rat from T6-7 or so down — then cut all limb sensory nerves and anesthetize ^{logically} the cord at highest segment exposed. Then s one or two of trunk nerves & see if get coordinated limb movt.
Can use all variations of cut and s's nerves to find out just where & how much organization there is the limb centers. Try progressive comben's on same animal, gradually cutting away more afferent roots.

24 Produce spinal sets à la Gerard and insert a motor nerve from forequarters, limb, phrenic, or such see if it can provide stream for limb patterns.

25) Cross just one m. of a group & leave rest of m's in position. Remove all dorsal-flexors and cross lat. gastroc. to the t.a. & ext. comm. tendons and see if withdrawal reflex is ever learned. One case so done was suggestive of adjustment.
Operation = relatively easy.
(Do it on fore-arm 1st. Cross lateral triceps.)

27) Cross-suture diff. ^{dorsal} roots of hind limb n's & see if function is regained on regeneration.

28) Cross-suture dorsal roots to opposite side of limb & see if there is any associated habit which can be dissociated by learning

29) Study the factors involved in adjustment of m. as tendon to the proper length

30) Cross-suture dorsal roots of hind limb to forelimb sensory n's or motor nerves.

31) Test thresholds of excitability & action currents of nerve before after separating it from its muscles.
(See Sherrington)

32) Train monkeys + & - Prio to simple patterns, then cut out enough of striate area so that the retinal pattern could not possibly be projected as a spatial pattern - use it as basis of explaining the physiology of visual sensation, visual projective processes in cortex, etc.

(33) Thorough comparative study of the two-joint effect of limb musculature and implications of the limb mount as a whole in primitive forms to gradual finer result as go up scale for c.p.s. function.

(34) Could reverse direction of sensory n's. $S \rightleftarrows$ by suturing central root to neighboring peripheral stump and peripheral root to nearby central

(35) Connect phrenic w. n. to orbicularis m. - make rat wink continually, or to ear m., or whisker facial m's, or to one or 2 of the eye muscles that pull in same direction. When rat has learned to counteract pull of phrenic pulses w. other m's, cut off cortex.

(36) Cross dorsal root of ~~ret. cervic.~~ (2nd cerv. n.), whose gang. lies outside vertebral, to the accessory n. & see if get unipolar reflex. Study with action currents.

(37) Find out if they know why muscle contracts more strongly under tension - if not cut dorsal roots & see if it is reflex

(38) See if lower forms increase tension by increasing frequency of discharge only

(39) get a 2nd R_i dependent on a I_{ry}. See if removal of motor periphery of I_{ry} will not cut 2nd R_i, then conclude central patterns of I_{ry} didn't develop normally.

Two-Headed Cow

Saw all 4 eyes blink together.

No. of nostrils same.

Owner reported:

jaw m's, tongue m's, always act synchronously
fly lights on one nose, he tries to lick it off w. tongue
of other head.

Occasionally very slight moult of eye-brows would occur
w/out all 4 going off.

Eyes pretty well covered, doesn't seem to use them, but
owner ^{says} thinks "he can see w. em, but sees better w.
main head."

That I saw nostrils in main head working w/out any
nostril moult in other nose.

Salivary discharge occurs in accessory mouth when
main head feeds.

One head = bull, main head = cow, has bladder and tits
but they're not well formed and don't give milk.

Says quite a few doctors been in to study it.

6 legged calf.

2 extra legs come off lateral to normal limb on right side.

One of these pretty well formed, and shows slight flexion mov
when animal walks.

Mov'ts occur w. the walking m's. The contraction seems
to occur toward end of support phase.



Kelly says can save animals after they die
for price of carrying away. Natural's Freak

Operation for Deafferentation

Incision midline from between hind legs up to 1 in. poster. to front legs.

Clear muscle away from vertebrae, starting w. sacral and working upward.

Nerves come in at slant, ganglia on top, and have to be tied out.

Snip off the spinous processes first as close down as possible. Then get sides.

Back near sacrum see ganglia completely so as to distinguish clearly the dorsal from ventral roots.

Cut away from vertebrae w. scissors.

Clean away down to 2nd layer of -pophyses.

Get in between vertebrae w. scissors and cut.

Then cut off to sides. Dig out the dorsal roots.

Use large hooks to pull m's apart.

Get a curved board w. hooks to tie rat on. narrow about size of rat so retractor chains won't have to be too long.

Don't go below most dorsal row of -pophyses, especially toward thoracic region - or will cut m's and also will cut into body cavity.

Remove 6 dorsal roots, starting with lumbar 2 and going down to peduncal wh. is located about 1 segment behind the crests of the hip bones. Can feel floating ribs. Then



What about going in on one side only.



saw & lift out the side piece.
saw

Can go in on one side OK. as diggs
Saw in center of arch above, and just below
the pophyses on side. Can feel or see rib entering
column if open up far enough.

Controls = same operation, sans getting dorsal roots.

Scrape bone well - don't get too far down
between vertebrae, then hold muscles back & lay cotton
or something over to stop blood.

Do deafferentation by locating a definite segment
or two, cutting away vertebrae on both sides
top and then just cutting thru all those dorsal
roots in the given region.

May find that the given dorsal root (locate ganglia
of that segment) goes in ventral or lateral to all the
other dorsal roots & can therefore cut 'em all right
at that point. It would be easy w. these long dorsal
roots to loop the nerve back and suture it to a muscle.

Can do as above - The grey matter comes down just
below 2nd lumbar, and it separates the dorsal roots
from the two sides. The the incoming g. root separates
those above from those below.

cut all these - how many?



Have to open up several vertebrae in region lumbar 2.
The motor roots are then way down below & all on the side
are dorsal. Use dissecting scope to cut 'em & use small
electrodes to test whether dorsal or ventral. After cutting off
one vertebra can snip others by putting scissors in along
opposite roots, then wait until the centers.

M⁴ Transposition - Foreleg



Dorsal surface left arm

pulls hand laterally.
pulls hand back - mainly just 2 digits, but does not open fingers.
" " whole hand & does open → fingers.
" " wide long tendons

use a	for muscle
" b	" tendon

cut origin of a from humerus and tie it laterally to ulna



moves whole hand not fingers
" " + fingers = full flexion.
" large group here. One inserts deep
& fleshy on bone - excise
superficial is a long m. - use for muscle?
deeper is a long tendon - " " tendon?

two-joint m's.

Watch length w. elbow flexed & extended.

" Origin attachment to upper arm m's.

Bring flexors up medially & extensors down where the bone was.

ulna is stranger, better to leave it in than radius.

Maybe can break ulna off and then tie the stump to the radial so they will fuse. Probably wouldn't have to tie it, just scrape the medial surfaces of both radial & ulna & it'll fuse by the time tendons heal. better 'cause

Flexors made to come up medially & extensors laterally
See how little of the ulna can break out.

Do the operation suggested back, on two more legs so are sure of the mechanics of the preparation.

Then begin to figure an incision and the general procedure.

If it's going to be possible, get a couple animals with just the two m's left in normal position.

Free the ulna both above & below before removal.

Better bring the flexor over laterally & extensor medially. See if can't sew several muscles together instead of trespassing just one.

Can bring flexor into position by cutting out proximal end of ulna.

The preparation will be weak, but try it - can't use training that will bring much strain on it.

Don't have to cut out the ulna to cross ~~extensor~~ ^{flexor} - only ~~extensor~~ ^{flexor}.

See if can get an ~~extensor~~ ^{flexor} across w/out cutting out the ulna. - by cutting out radius.

* To get the flexor up to extensor position, cut the inner $\frac{1}{2}$ of the ulna bone away, can also file away some of radius, then pull the flexor up thru this hole.

Try a couple operations now for locating best position for incision & possibility of getting at the various m's.

Make a rat w. couple of normal controls

Cut the origin of the extensor medially off the humerus so as to eliminate the double joint effect.

Incision probably best along posterior aspect of the arm.



Find out circ. & innervation of those m's to be used.

Nale in ulna has to be quite far proximal.

Nerve runs under most lateral extensor near ulna.

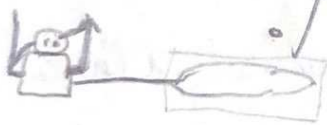
Getting at origin of the extensors will be difficult.

Have to lift up the triceps in that region. Split between triceps and biceps. Push a hole thru from lateral to medial just dorsal to biceps tendon to push the extensors thru.

Open up cleanly around the origins just after incision. Make incision a little lateral to posterior. on lower arm & on upper arm.

A large nerve runs under center superficial flexor. The thinnest deep flexor for tendon, or better a thick tendon lying more medial & superficial.

Need an arrangement to hold the rat & its legs tie to toes. But have to shift rat on both dorsal & ventral side.



Can do a couple operat.'s remaining the ulna, if want to.

Might be better to have a couple large lead weights w. poles in em to tie the arms to, then could shift easily.

(Could do upper arm by having thread extensions) the two biceps go back, one on each side and the triceps, anterior, third, with nerve, comes over anteriorly. Looks good. Reconsider

Can suture to fascia on posterior surface of forearm right beside ulna & send thread thro' to crossed triceps.

Cut away medial strip of triceps and suture the other over so can tie tendon anteriorly to collar bone.

Incision will have to be lateral to get at triceps origin.

See the crossed triceps (3 open) on first (fairly extended) & then the triceps.

May have to burn way thro' a lot of blood vessels.

Can save the nerve that comes out of distal triceps anteriorly by cutting off tiny flap of the triceps fascia.

Outside extra strip of triceps medially that can be cut out.

Upper Arm ↑↑

Lower Arm:

A bunch of flexors come off a bone process up at the elbow - which might be cut off and the entire origin transferred.

With piece of bone on there, one could tie the origin very tightly. The question is can the blood vessels and nerves be pulled so far out of their courses?

Watch nerve along ulnar & up under origin of extensor m. Keep only the very central extensor tendon, its thin & ribbon, but only one that extends hand straight.

up to lower arm. ^{1/2} up the upper arm & see what comes of it
literally - cutting n's & blood vessels to skin &
lower arm.

Go in deep after triceps origin & cut only tendon,
then split the fascia at origin so can pull farther
around in front. Can chip off process on humerus.

1. Free cleanly, cauterizing nerves & blood vessels.
2. Remove spino deltoidens, & deltoid acromial.
3. Cut off lateral ~~deltoid~~ triceps.

Lateral biceps has fleshy insertion & is innervated to
way down from medial side.

4. Free origin & insertions of n's to be used.
5. Cut out biceps
6. " " triceps - sew biceps in place.

M-cross - upper arm.

Be very careful of nerve to later. biceps. It comes
in with fleshy insertion along humerus.

Be sure and cut the long tendon that fastens
arm to trunk muscul. medially.

Pull ~~extensors~~ out of way to cut the tendons of biceps.
Fasten triceps more medially to prevent adhesions
to distal ulna.

Make incision laterally on forearm rather in posterior.
Clean out deep n's along the humerus.
Clear hair off face & back so won't get in way.

Have superficial triceps tendon to tie the biceps to. Can make a good cross there if can keep biceps innervated.

Then sew large triceps very carefully to the ~~lateral~~ no, have to sew it to the humerus bone same low or other or else will get the 2-joint effect.

This upper arm cross can be done very well, and once the extraneous m's are removed makes a very nice preparation.

Start out by removing the later. tri. along with the spino-deltoid. Then get dorso-trachlearis, and cut long tri. & remove medial triceps.

Then go to work to free the biceps - free the later. biceps from lateral and ~~and~~ underneath rolling it toward humerus and scraping m. from off humerus keeping the nerve which runs from medial biceps into it.

Then free the medial triceps as much as possible before cutting its tendon.

Can cut biceps tendons quite low if pull on them while ext. m's are retracted.

Don't have to cut into the pectoral m's. The main nerves to the biceps enter high in both m's. can probably break the lower nerves. Free the diff's m's. cleanly. Find a better way of attaching triceps muscle. (Loop the thread around the ulna or radius near normal insertion of biceps).

Operation for Deafferentation of Hind Limb

Skin incision from mid-thorax to pelvis

Cut ribs off vertebrae close to base.

Scrape bone clean on sides with scalpel. only a little below main dorsal zygophyses

Scrape so can get at ^{T13}L1, L2, & L3 with the small circular saw. (rib, T13, L1)

When holding vertebrae by spine, with heavy forceps, saw horizontally just below the zygophyses


Saw along all three vertebrae.

Then cut the connections between the zygophyses of last & first vertebrae, from those beyond & behind.

Then by getting zygophyses of L3 w. scalpel can w. leverage action break off the L3 vertebra & if lucky can pull all 3 by one motion.

With fine needles ^{up the spine} pull dorsal roots over ^{full length of exposure} & ^{dorsal cut} laterally full length & cut anteriorly - all of them & pull ~~posteriorly~~. (Don't allow meninges to dry.)

When all cut out & ~~partially~~ stop all bleeding & sew fasciae w. discontinuous suture & skin w. continuous suture.

Better to remove T13, L1, 2, 3 and remove only $\frac{1}{2}$ the ankle to help support cord .

Keep the animal under anesthesia about 6-10 hrs after the operation if possible - so that sensitivity of cut nerves & muscles/subsides.

Deafferentation of hind limb. Problem.

- 1) Deafferent both limbs in 3 cases.
- 2) Have control w. everything done except cutting the roots

Test for tones of the leg - under slight anaesthesia
" " increased sensitivity of extensor reflexes.
" simple mov't.s vs. complex mov't.s

Add bibliog. of Moldauer to that of Weiss

Get a list of reflexes & of the normal in deaff'd.
Watch position of head & its effect on mov't of limb.
Effect of posture of deaff'd limb on the initial mov'm't
of that limb (cf. normal & deaff'd).

Forearm Cross. Biceps Triceps.

The nerves to the biceps & triceps are fairly long & can probably be crossed.

The ~~medial~~ ^{long head} biceps ^{under deltoid} origin can be dislodged at the shoulder, giving the muscle more length and better position for extension. Try to include the muscle biceps short head w. biceps long head.

The biceps are medial and the lateral m. is the brachialis

The brachialis is innervated medially by same n. as the biceps. (the musculocutaneous n.) and also by a small branch of radial n. which innervates the triceps.

Clean the upper arm more cutting n's and blood vessels to lower arm where necessary.

The biceps to elbow can be done OK. Question of whether the triceps can be brought forward. It can!

1940 Program - perfect the fore-arm operation and then turn off a bunch of upper-arm cases

- 1.) Forearm crosses 6-7
- 2.) Upperarm " 6-7
- 3.) Both forearm + upper arm. 6-7

Forearm Cross

The extensors may contract while fingers are flexed.

Cut out other n's & watch a control for reciprocal, control & relaxation.

Extensors n's = supplied by radial n.

Flexors " = " " " median, ulnar, & musculo
cutaneous

For radial n. see pg 274 & 275
" median " " " 273



Remember that most of the trick movts are performed by n's left in place. But try to use finger n's rather than wrist for trayposition - can use wrist tendons.

Use the most lateral flexor that pulls fingers

[Go there nerve first & see if can cross 'em.]

1) long n-branch in flexors

Extensor n. comes down later. to brachialis - doesn't seem to send and branch down to wrist all go to extensors.

(n's of hand can be eliminated by cutting)
extensors of ulnar, median, at wrist!

1) Have to cut out hand m's by cutting median and ulnar n's at wrist.

2) Cross extensors so they have to flex the hand & fingers. Use 2 tendons, one to hand & one to fingers. = main problem.

3) Decide how to cross flexors to extensor position later.

4) Have to use 90-100 day rats younger = too small.

Now small deep extensors that can be used for tendons, pull fingers back.

Deep flexors - "large medial m." & ext. dig. super.

Can ppt medial one thru bone, can ppt both around.

Palmar flexors - put one thru the bones.

[Make a couple (4) controls w. diff't flexors & ext. (?) left in. Cut median & ulnar nerves]

Dissection - find out by elect. stim which branches of ulnar & median n's are motor.

Cross ext. m.s. (ext. carp. rad. lang. to tendon of flex. dig. profundus)
4) 4 4 4 brach.

Cross flex. m. flex. dig. prof. sup. rad. to tendon of ext. dig. commun.

Use ext. dig. commun. & leave the medial strip for a tendon.



Leave the prof. tendon that is most medial. (no) are just above right of middle - small & clean

Use the prof. flex. m. that is attached along the ulna & just roll it over the bone after filing the bone.

Leave some fascia attached to the ulna that can pull transversely across ext. m. to hold it in place. orig. lateral to it.
Cross ext. medially & flex. laterally.

Rat. incision - remove dorsal m's then flexors
Cut n's.

What about cutting holes in one of bones.
Cut out length of radius



Upper Arm Cross-over : || ||

Cut down triceps m. quite a bit. (no)
What about folding tendon back on itself
to make it longer. (Yes)

Open up well on forearm.
" " " over back.

What about removing all shoulder flexors. Pke
pectorals, deltoids, etc? (Yes)

See biceps quite tight in a position of extension
so ankylosis of extension won't occur.

Superficial jugular vein crosses above collar bone
medially. Can remove pectorals w/out cutting it.

Don't attach triceps to collar bone; it's too flexible
tie it to the tendons at head of ulna, medially & deep just
under the biceps tendon. Tie lateral to biceps tendon.
biceps May be able to take off most of pectoral m. if miss
the jugular vein & all lymph n's & blood vessels that
pass medially at medial end of collar bone.

Separate pectoral m. from skin m's.

Use hooks to pull skin apart in getting medially.

Can separate triceps m. from long triceps by
going in high & cutting deltoid loose first.

Can make incision way up back of neck if
of blood vessel line.

There are tendons on top of the humerus also that
triceps can be attached to, just lateral to old point of biceps tendon.

May be able to ankylose the shoulder joint by injury.

Nerves of Upper Arm (for cross-suturing)

nerve to biceps is long & will reach triceps easily.

L. Biceps n. is not long enough to reach biceps.

Medial triceps nerve is long enough to reach biceps

Suture biceps n. to long triceps nerve.

" medial triceps n. to stump of biceps & to brachial n.
a second n. enters l. tric. proximally & laterally.

Insert the triceps on the radius by removing the ext. carp. m. Then with sharp point make hole between radius and ulna & send curved needle thru. Send needle thru from medial to lateral so insertion will be medial.

Better leave the triceps intact, don't shave, then be less liable to infection.

There's a small origin of triceps on the humerus head may be all that's needed to keep.

Maybe ought to remove ext. carp. before loosening biceps/triceps.

Get med. triceps off cleanly — no! leave the distal end of the medial triceps to shield the joint & prevent ankylosis. Cut & tie its nerve and cut the proximal end of the m. out. Then suture the biceps & triceps to the med. triceps tendon.

cut out the coracobrachialis & leave in anconeus
leave only very short tendon of tric. b. on the olecranon.
? can get out other m's OK w. the med. triceps left in

If have to remove pectorals, remove them in a second operation. Cut tendon to lat. dorsi only.

Leave tendon of later. triceps attached to l. triceps tendon.

Leave skin over forearm fairly loose as it sloughs off.

Use lat. tric. instead of tric. long. slide brachialis up under the nerve & blood vessels. Tie lat. tric. origin to tendon of biceps & scrape bone under im. merely cut deltoids so can lift 'em out of way.

Lat. triceps can be crossed w. blood vessels and nerves intact. Cut spindle shaped in half and free upper end of triceps. Don't need a very long tendon on lat. triceps; it's pretty long anyway.

In cutting tendons of biceps, put hook on first carpi. quite far proximally.

Didn't see much in way of blood vessels entering lat. trice near origin so can cut to make it stretch out medially. Sew origin of lat. triceps to head of humerus.

Injured head of humerus bone where origins of lat. tric. & biceps come in contact.

Can cut all superficial blood vessels in upper arm including large vein that passes from elbow up between big & brach.

Can free tric. b. nerves & blood vessels pretty cleanly.

Muscle originates on medial and anterior face of humerus (along w. n. & brach.) does not do much flexing probably - also has head up poster. to biceps.

Nerve Cross =

med. triceps m. to combined brachialis + coracobrachialis
Have to cut collateral nerve branches to the
diff't m's, that are to be left in: biceps + triceps
long. Test this w. inductorium. Acclg to good block
neither has ~~but one~~ collaterals, only brachialis.

Biceps will be hard to deal with, maybe better use
medial and lateral triceps if can get two m's + large
enough.

The tric. lat. + tric. m. both supplied by same branch
which will make quite a way for resection.

Use tric. b. m. for biceps.

The biceps m. will reach tric. b. O.K.

" tric. lat. + tric. med. m's will reach brachialis O.K.

Use brachialis m. + tric. lat. for nerve cross.

Biceps nerve + tric. lat. nerve (possibly
question of keeping brachialis blood vessels intact).

Use brach. m. into tric. long. m.

" triceps b. m. " biceps m.

open up + remove lat. triceps + the deltoids
have the elbow joint intact sans injury to avoid ankylosis.

Use tric. b. m. into biceps

" brach. m. " m. triceps.

N's of Upper Arm

Cut. Maximus goes to humerus above biceps,
lat. dorsi below "
Anat. P. shows lat. tri. as strengthening elbow.

The nerve to acromio-deltoid branches off the axillary n.
where it comes to lateral surface & runs anteriorly to
the acromio-deltoid so have to be careful in removing
any of deltoid not to cut the nerve to the rest of it.

Leave pectorals attached to humerus if possible,
cut off just the top of process.

Pectoralis minor is not touched, but it is impossible to
leave the insertion of the major intact if going to remove
the deltoid tuberosity.

Be careful not to cut subscapular n. to shoulder n's

Tests for Front Leg Rin (Upper Arm).

- 1) Drop front quarters suddenly & arm is extended to hit the floor.
- 2) Pinch the skin on neck just above shoulder held head.
- 3) Locomotion support.
- 4) " suspended.
- 5) Hold by tail w. hind feet just off floor.
- 6) Placing Rin.

The operation

Muscles excised:

spino-deltoid
acromio-deltoid
later. triceps
dorso-epi trochlearis brachii
medial triceps
coracobrachialis

{ insertion of cutaneous maximus
" " pectoralis major

Bones

snip off top of deltoid tuberosity

Nerves cut:

cutaneous branch of axillary
small cutaneous twig of the radial
nerves to excised m's.

Crossing triceps long. nerve into biceps. brachialis. →

Med.-long. incision, elbow to mid line.

Counterize vein over pectorals + pull 'em back
With retractors on pectorals + on hand stretch out →
axillary region

Free n's from blood n's + cross.

The bic. n. = long, easy to get.

Tric. = short + will have
to be separated up the
trunk a ways + down
into the m.



Free the triceps n. by pulling
the main trunk posteriorly then n. lies on top, instead
of under the blood vessels!

Plenty of slack in the nerves.

Free the tric. lo. n. quite a ways up trunk so that
the suture will be in straight line, not in loop. →

Free the musculo-cut. down below branch to biceps
& cut it after this branch ~~and~~ and insert the tube
ends in artery. - Then don't have to pull tric. lo. bundle
up the trunk very far & can make suture in straight line.

Tie off the musculo-cut. n. before cutting.

Can put the tric. lo. n. directly into biceps m. or can
put biceps nerve directly into tric. long. →

Can put both bic. & brach. n's into tric. lo. n. by
removing biceps m.



Can free med. tric. n. OK and put into
brach. & bic. into tric. lo. so have a

In young rats, the med + lat. tric.

branches come off right near the tric. lo. branch as three
or so n. spreading out. There is a larger more intact branch
running 1/2 way up trunk that comes off first & goes on out forearm.

Cut out + tie off central med. that want
be used.

Operation for Crossing Biceps & Triceps N's

Incision along medial arm above highest nipple - clear away fat & fascia. - cauterize large nerves over deltoid m's.

Cut insertions of pect. m's & deltoids up ~~proximally~~ on humerus so that axilla is well opened - keep so w. a retractor.

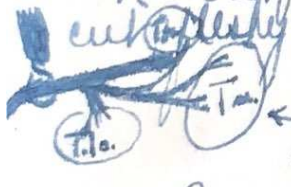
Locate musculo-cut. n. & cut origins of biceps m. & ^{coraco-brachialis} m. Cut n. to biceps well distally - may leave a bit of m. on end of it. do not pull " n. back very far ^{up} the trunk. if plenty long to reach tric. lo. as is.

Get out biceps m's at insertions & coracobrachialis.

Retract ^{proximally} large ulnar n. ^{& medial n's} after freeing it from fascia so as to expose radial n. w. its branches to triceps m's.

Free radial n. & lift it so can free branches to m's. Free branch to tric. lo. from the anterior side. Better to free this branch down into the m. rather than pulling it up trunk and so possibly injuring the fibers to medial tric. Cut it obliquely close to main trunk.

Retract ulnar & medial n's farther distally so can cut ~~distally~~ origin of tric. med. n. away from humerus.



Expose the two rami to the med. triceps m. & free them & cut them distally.

Remove tric. med. getting down between it & tric. lo.

Pulverate stump of tric. lo. anter. to radial n. & stick biceps branch into tube.

Pulverate tric. med. br. and stick brachial n. into tube.

Free & cut the brach. n. - don't have to pull it very far up trunk.

Special care in freeing the nerve branches to muscles especially where the central outgrowing fibers are concerned so as not to get a microglia outgrowth i.e. on biceps m. and on tric. lo. & med. to save the tric. med. fibers.

Reoperate later - laterally to remove lat. tric. m. & medially to check up on nerve crosses & cut stray reg. fibers to m's.

RCW experiment notes, Data, details,
1938, 1939,

#6
Solutions used, Surgery techniques.

Possible problems to follow up