An overview of the anatomy of the bovine hindlimb with comparison to the dog.

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Original photos courtesy of Mary Ferguson
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Video clip by Dr. David Kilroy
Lateral view of the left stifle and hock regions of the hindlimb of the calf

1. Biceps Femoris

3. Lateral Head of Gastrocnemius

5. Cranial Tibial

2. Fibular Nerve

4. Quadriceps Femoris

6. Lateral Digital Extensor
Lateral view of the left stifle and hock regions of the hindlimb of the calf

7. Deep Digital Flexor

9. Calcaneon Tendon

8. Tibial Nerve

10. Calcaneus
In the ox, the biceps and superficial gluteal are fused to form the large gluteobiceps, giving rise to the more rounded appearance of the rump.

The calcaneon tendon is formed by contributions from tendons of insertions of five muscles. The gastrocnemius and superficial digital flexor make up the largest part but the biceps femoris, gracilis and semitendonosis also contribute to the tendon. In this way all these muscles may be considered to have some function in extending the hock joint. This is also true in the other domestic animals.
The muscles and tendons which contribute to the calcaneon tendon are important clinically when considering the condition known as Spastic Paresis in cattle.

This condition is currently thought to be inherited via a recessive gene.

It may be seen in most breeds of cattle from as early as 6 months of age. As the animal ages the gastrocnemius muscle gradually tightens and contracts, causing constant extension of the hock joint via the calcaneon tendon. This causes problems with movement and gait.

Because this condition is heritable, affected animals should not be used for breeding. Treatments for the condition include tenotomy (cutting the tendon) of the gastrocnemius muscle thus relieving some of the contraction on the calcaneus, or partial or complete cutting of the tibial nerve which innervates the gastrocnemius and superficial digital flexor, both important extensors of the hock joint.
The Quadriceps is a large muscle which lies on the cranial aspect of the femur.

It is made up of four heads;  
Vastus Lateralis  
Vastus Medialis  
Vastus Intermedia  
Rectus Femoris

The tendons of insertion of all four heads crosses the stifle joint to insert on the tibial tuberosity.

The patellar tendon contains the largest sesamoid bone, the patella. In the ox and horse the patellar tendon is divided into three parts.

All four heads therefor act to extend the stifle joint but only one acts to also flex the hip joint, the rectus femoris. Because this head originates just cranial to the acetabulum of the ilium, it crosses the hip joint and can therefor act to flex it. The other heads originate on the femur and so do not cross the hip joint.
As mentioned, the quadriceps is the extensor of the stifle joint and is innervated by the femoral nerve.

Femoral nerve paralysis is a common finding in large newborn calves often after the use of a calving jack/ mechanical force to assist birth. If the femoral nerve is damaged it leads to an inability to contract the the quadriceps. This means the calf is unable to stand as standing requires the stifle joint to be extended. Calves may therefore require assistance to suckle.

Atrophy of the quadriceps occurs after a short time due to lack of usage and a lateral luxation of the patella may be seen due to a lack of tension on the patellar tendon (remember that the patella develops in the patellar tendon - the tendon of insertion of the quadriceps muscle).
<table>
<thead>
<tr>
<th>Muscle</th>
<th>Origin</th>
<th>Insertion</th>
<th>Innervation</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biceps Femoris</td>
<td>Ischial Tuber</td>
<td>Patella, Tibial Crest &amp; Calcaneus</td>
<td>Sciatic Nerve</td>
<td>Extend Hip Joint, Flex or Extend Stifle Joint, Extend Hock Joint</td>
</tr>
<tr>
<td>Gluteals (3)</td>
<td>Ilium</td>
<td>Greater Trochanter of Femur</td>
<td>Gluteal Nerves</td>
<td>Extend Hip and Abduct the Limb</td>
</tr>
<tr>
<td>Tensor Fascia Lata</td>
<td>Ventral aspect of the Wing of the Ilium</td>
<td>Patella</td>
<td>Cranial Gluteal Nerve</td>
<td>Tenses the Fascia Lata to Extend and Stabilise the Stifle Joint</td>
</tr>
<tr>
<td>Sartorius</td>
<td>Wing of the Ilium</td>
<td>Patella and Disto-medial Femur</td>
<td>Femoral Nerve</td>
<td>Flex Hip and Adduct Limb</td>
</tr>
<tr>
<td>Quadriceps</td>
<td>See previous slide</td>
<td>See previous slide</td>
<td>Femoral Nerve</td>
<td>See previous slide</td>
</tr>
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<tr>
<td>Adductor</td>
<td>Ventral aspect of the Pelvis</td>
<td>Medial aspect of the Femur</td>
<td>Obturator Nerve</td>
<td>Adduct the Limb</td>
</tr>
<tr>
<td>Gracilis</td>
<td>Pelvic Symphysis</td>
<td>Medial aspect of the Stifle and Calcaneus</td>
<td>Obturator Nerve</td>
<td>Adduct the Limb and extend the Hock</td>
</tr>
<tr>
<td>Pectineus</td>
<td>Prepubic tendon</td>
<td>Medial aspect of the Femur</td>
<td>Obturator Nerve</td>
<td>Adduct the Limb</td>
</tr>
<tr>
<td>Semitendinosis</td>
<td>Ventral aspect of the Ischial Tuber</td>
<td>Tibial Crest and Calcaneus</td>
<td>Sciatic Nerve</td>
<td>Extend Hip Joint, Flex Stifle Joint, Extend Hock Joint</td>
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<td>Semimembranosis</td>
<td>Ventral aspect of the Ischial Tuber</td>
<td>Medial aspect of the Femur and Tibia</td>
<td>Sciatic Nerve</td>
<td>Extend Hip Joint and Flex Stifle Joint</td>
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</tbody>
</table>
Notice that the adductors of the hindlimb are innervated by the obturator nerve.

This nerve can become compressed and damaged during a difficult birthing in cows as the foetus passes through the birth canal and compresses the nerve against the wall of the pelvic cavity.

This can cause an inability of the newly calved cow to stand, and a ‘splits’ stance can be seen due to the inability to adduct the limbs.

The obturator nerve comes off the lumbosacral plexus and leaves the pelvic cavity through the obturator foramen.
The nerves of the hindlimb arise from the lumbosacral plexus. Starting cranially they are the femoral nerve, obturator nerve, gluteal nerves and the sciatic nerve.

The video on the next slide demonstrates the lumbosacral plexus in a dissected dog. The same pattern of organization is found in the ox and other domestic species.
Double click on the video to play it. It may take a few seconds to start. If it does not play it can be downloaded individually from the OVAM website.

The lumbosacral plexus - the nerves of the pelvic cavity.

Presented by Dr. David Kilroy
1. Quadriceps
2. Adductor
3. Biceps (reflected ventrally)
4. Lateral Head of Gastrocnemius
5. Cranial Tibial
6 & 6'. Long Digital Extensor and its tendon of insertion
7 & 7’. Fibularis/Peroneus Longus and its tendon of insertion
8 & 8’. Lateral Digital Extensor and its tendon of insertion
9. Deep Digital Flexor
10. Calcaneon Tendon
11. Sciatic Nerve
12. Tibial Nerve
13. Fibular Nerve

Lateral view of the left stifle and hock regions of the hindlimb of the calf.
In the dog, we see four sesamoid bones in the stifle joint.

The largest is the patella which is found in the tendon of insertion of the quadriceps femoris on the cranial aspect of the joint. A patella is also found in the ox and horse.

However in the dog there are three sesamoid bones found caudal to the stifle joint, the fabellae. Two of these develop in the tendons of origin of the two heads of the gastrocnemius muscle. The other develops in the tendon of origin of the popliteus muscle. These three sesamoid bones are not found in the ox or horse.
Radiograph of the left stifle joint of a dog.

1. Patella

2, 3, and 4. Fabellae

5. Patellar Tendon

6. Tibial Tuberosity

2 and 3 develop in the tendons of origin of the two heads of the gastrocnemius while 4 develops in the tendon of origin of the popliteus. These are absent in the ox and horse.
Lateral view of flexed stifle region of the left hindlimb.

Here we can clearly see the large sciatic nerve (1) which lies between the biceps (which has been reflected) and the adductor. Notice that it divides just distal to the stifle and is continued as:

- **Fibular Nerve (2)**
  This supplies the muscles on the cranial aspect of the tibia. Notice how it crosses the lateral head of the gastrocnemius.

- **Tibial Nerve (3)**
  This supplies the muscles on the caudal aspect of the tibia. You can see how it dives between the two heads of the gastrocnemius before emerging and running distally just cranial to the calcaneon tendon. Try to spot it in the previous pictures.
Medial view of the hip, stifle and hock regions of the left hindlimb.

1. Head of Femur
2. Vastus Medialis
3. Medial Head of Gastrocnemius
4. Calcaneon Tendon
5. Tibial Nerve
Medial view of the hip, stifle and hock regions of the left hindlimb.

6. Calcaneus
7. Tibia
8 & 8’. Cranial Tibial and its tendon of insertion
9 and 9’. Long Digital Extensor and its tendon of insertion
10. Fusion of Metatarsals 3 and 4
Notice in the previous image that the medial aspect of the tibia is bare. It has no muscle coverage making it prone to trauma in this area.

The head of the femur, which can be seen in the previous image, articulates with the acetabulum of the os coxae to form the hip joint.
A view of the muscle situated on the cranial aspect of the tibia and fibula, between the stifle and hock joints.

1 & 1’. The large Cranial Tibial muscle and its tendon of insertion. In this view it is covering most of the other muscles such as the Long Digital Extensor and the Fibularis Tertius.
A view of the muscle situated on the cranial aspect of the tibia and fibula, between the stifle and hock joints.

2. The tendon of insertion of the Long Digital Extensor

3 & 3’. The Lateral Digital Extensor and its tendon of insertion
Here we can see four of the major muscles found on the cranial aspect of the tibia, between the stifle and hock.

1. Cranial Tibial
2. Long Digital Extensor
3. Fibularis Longus
3. Lateral Digital Extensor

Tuesday 2 October 12
In the dog we see five metatarsals, one for each digit. These can be numbered from 1 - 5 starting medially. In the ox however there are only two digits, which are the equivalent of digits 3 and 4 in the dog. Rather than seeing individual metatarsal bones as in the dog, metatarsals 3 and 4 are fused in the ox to form one bone. This could be thought of as the cattles answer to the horses cannon bone with the exception that the cannon bone in the horse is just metatarsal 3.
Cranial view of the hock joint and the structures distal to it.

1. Fusion of metatarsals 3 and 4
2. Cranial Tibial
3. Tendon of the Long Digital Extensor
4. Tendon of the Lateral Digital Extensor
Cranial view of the hock joint and the structures distal to it.

The large cranial tibial muscle and its tendon of insertion can be seen (2). It inserts on the medial aspect of metatarsal 3 and flexes the hock joint.

The tendon of the long digital extensor can be seen crossing the hock joint (3). In the bovine animal this tendon divides into three parts, 2 of which insert onto the distal phalanx of the medial digit. The other part joins with the tendon of the lateral digital extensor (4) and these insert onto the distal phalanx of the lateral digit.
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<tr>
<td>Gastrocnemius</td>
<td>Caudal aspect of distal femur</td>
<td>Calcaneus via calcaneon tendon</td>
<td>Tibial Nerve</td>
<td>Flex stifle and extend hock</td>
</tr>
<tr>
<td>Superficial Digital Flexor</td>
<td>Caudolateral aspect of distal femur</td>
<td>Calcaneus and plantar aspect of middle phalanx</td>
<td>Tibial Nerve</td>
<td>Extend hock and flex digits</td>
</tr>
<tr>
<td>Deep Digital Flexor</td>
<td>Tibia</td>
<td>Plantar aspect of distal phalanx</td>
<td>Tibial Nerve</td>
<td>Flex digits</td>
</tr>
<tr>
<td>Cranial Tibial</td>
<td>Lateral proximal tibia</td>
<td>See previous image</td>
<td>Fibular Nerve</td>
<td>Flex hock joint</td>
</tr>
<tr>
<td>Long Digital Extensor</td>
<td>Extensor fossa of femur</td>
<td>See previous image</td>
<td>Fibular Nerve</td>
<td>Extend stifle, flex hock, extend digits</td>
</tr>
<tr>
<td>Fibularis Tertius</td>
<td>Extensor fossa of femur</td>
<td>Dorsal aspect of metatarsus</td>
<td>Fibular Nerve</td>
<td>Extend stifle and flex hock</td>
</tr>
<tr>
<td>Lateral Digital Extensor</td>
<td>Proximolateral Tibia</td>
<td>See previous image</td>
<td>Fibular Nerve</td>
<td>Flex hock and extend digits</td>
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Notice that the muscles which lie on the cranial aspect of the tibia are innervated by the fibular nerve, while the muscles which lie on the caudal aspect of the tibia are innervated by the tibial nerve. But remember that both the fibular nerve and tibial nerve are both continuations of the sciatic nerve.