Anatomy knowledge, and the skill to apply it, is arguably the most important facet of safe and competent acupuncture practice. The authors believe that an acupuncturist should always know where the tip of their needle lies with respect to the relevant anatomy so that vital structures can be avoided and so that the intended target for stimulation can be reached. This article describes the anatomy of the upper limb and shoulder girdle, and lower limb and pelvis, relevant to safe needling practice.

Keywords
Anatomy, acupuncture points, safety.

Summary
This is the third of a series of articles that highlight human anatomy issues of relevance to acupuncture practitioners. Whilst the framework of the articles is built around anatomical structures that should be avoided when needling, the aim is not to frighten practitioners, but rather to instil confidence in safe needling techniques.

Most textbooks of acupuncture use relative scales to determine the surface localisation of acupuncture points. However, the safest and probably the best way is the orientation on anatomical landmarks. Moreover, it is important to know what lies beneath the surface, i.e. which morphological structures could be the target of the needling, and, on the other hand, which structures should be avoided (e.g. vessels, nerves etc.).

Introduction
The scapular spine is usually palpable in its whole extent and ends in the acromion. The acromion forms the lateral border of the shoulder and is connected to the coracoid process by the coracoacromial ligament. The coracoid process is best palpated when gliding the finger laterally along the caudal aspect of the clavicle. The first palpable bony resistance should be the coracoid process. The next bony landmark is the lesser tubercle. To discriminate between the coracoid process and the lesser tubercle, the upper arm is rotated: the coracoid process doesn’t follow the movement.

The deltoid muscle has three different parts originating at the clavicle, the acromion, and the scapular spine. The common insertion of these parts is the lateral humerus. When the arm is...
abducted, usually two small indentations become visible. The anterior indentation is between the clavicular and the acromial attachments of deltoid, and the posterior indentation is between the attachment to the acromion and the attachment to the lateral third of the scapula spine. In some cases these indentations may not be visible, but they are almost always palpable.

Figure 2  This figure includes two anterolateral views of the right shoulder (upper images), and three lateral views (lower images). Key to labels: d: deltoid; pma: pectoralis major; b: biceps; sb: short head of biceps (tendon inserts onto the coracoid process); pmi: pectoralis minor; c: clavicle; tr: triceps; sb: subacromial bursa; tma: teres major; tmi: teres minor; is: infraspinatus; ss: supraspinatus insertion. The lower right image illustrates the likely target of needling at the two points marked. At LI15 the needle probably passes through the subacromial bursa before reaching the supraspinatus insertion, and at TE14 the intended target is probably the musculotendinous part of infraspinatus. Images courtesy of Primal Pictures Ltd. www.anatomy.tv
Important acupuncture points of the shoulder region
LU1 (Zhong Fu) is located at the medial and inferior border of the coracoid process. Needling is performed in a slightly cranial and obliquely lateral direction (towards the common origin of the short head of the biceps and the coracobrachialis). LU2 (Yun Men) is located above LU1, directly beneath the clavicle. Neither of these two points is really dangerous in terms of the risk of pneumothorax, if needling is performed in the correct direction, i.e. slightly cranial and obliquely lateral.

The anterior impression within the deltoid muscle is the landmark for LI15 (Jian Yu), and the posterior for TE14 (Jian Liao). The intended target of needling at LI15 is probably the insertion of supraspinatus. It should be noted that when aiming for this structure the needle will traverse the subacromial bursa, which may, in some cases (usually older individuals), communicate with the glenohumeral joint. The intended target at the point TE14 is likely to be the musculotendinous part of infraspinatus. The common insertion of the deltoid muscle represents LI14 (Bi Nao), lying roughly on a line between LI11 and LI15 [location of LI11 is given below].

Landmarks of the elbow region
The bony landmarks of the elbow region are the olecranon on the dorsal aspect, and the medial and lateral epicondyles. The epicondyles are found just beyond either end of the elbow (antecubital) crease, which appears on the ventral aspect when the arm is flexed. Another important landmark on the ventral aspect is the tendon of the biceps muscle. It inserts at the tuberosity of the radius, and is best palpated when the arm is flexed and supinated. In addition, the bicipital aponeurosis, an almost triangular membrane, runs from the biceps tendon to the deep antebrachial fascia, covering the cubital fossa, and it protects, for example, the brachial artery and the median nerve.

The brachial artery provides the main arterial supply to the arm. It is the continuation of the axillary artery (beginning at the level of the lower border of the teres major muscle). In the antecubital fossa, under the bicipital aponeurosis, it splits into the radial and the ulnar artery. During its course on the medial side of the humerus it is accompanied by the median nerve. The ulnar artery usually begins just medial (ulnar) to the biceps tendon; the radial artery begins near the neck of the radius and runs deep to the brachioradialis muscle.

A rather frequent variation is the superficial brachial artery. About 20-25% of people in the western world have this in addition to the main brachial artery. About 5% have it as the sole arterial connection to the forearm.

Important acupuncture points of the elbow region
LU5 (Chi Ze) is located directly radial to the biceps tendon in the elbow crease, and PC3 (Qu Ze) directly ulnar to the tendon. Both points overlie the distal part of the brachial artery and the proximal parts of the ulnar and radial arteries, as well as the median nerve. Because the brachial artery is frequently rather superficial, it is advisable to palpate for a pulse prior to needling these points. LI11 (Qu Chi) can be found at the radial end of the antecubital crease, midway between the biceps...
tendon and HT3 (Shao Hai) is located between the lateral epicondyle, and between the ulnar end of the crease and the medial epicondyle. SI8 overlies the ulnar nerve in the ulnar groove at the posterior aspect of the medial epicondyle.

Landmarks of the wrist region

One important bony landmark of the wrist and carpal region is the pisiform bone, which can be found just distal to the medial end of the distal wrist crease. It is best palpated with the wrist extended. The pisiform bone is embedded as a sesamoid bone into the tendon of the flexor carpi ulnaris muscle, which inserts at the hook of the hamate and the fifth metacarpal. The tuberosity of the scaphoid can be palpated under the distal wrist crease, at the transition of the lateral to the middle third, and also is best palpated in extension. If the wrist is flexed, usually two tendons become visible: lateral (radial) lies the flexor carpi radialis, medial (ulnar) the palmaris longus muscle. However, this small muscle is absent on one or both sides in about 15% of people.

The median nerve runs along a line from the junction of the ulnar 1/3 and the radial 2/3 of the interepicondylar line of the humerus and the midpoint of the proximal wrist crease. At the distal forearm it lies on the ulnar aspect of the tendon of the flexor carpi radialis muscle.

The ulnar nerve takes its course along a line from the posterior aspect of the medial epicondyle to the radial border of the pisiform bone. The ulnar artery joins the ulnar nerve at the transition from the proximal to the middle third of the forearm and usually runs on the radial aspect of the nerve.

The radial artery runs from the brachial artery below the intercondylar line, towards the radial aspect of the wrist, where it is easily palpable over the distal radius, radial to the tendon of the flexor carpi radialis muscle. From there it enters the ‘anatomical snuffbox’ on the dorsoradial aspect of the carpus. The ‘snuffbox’ is bordered by the tendons of the extensor pollicis brevis and

Figure 4 This is a composite view of the palmar aspect of the right wrist illustrating the main nerves and vessels, and five acupuncture points. Key to labels: mn: median nerve; ra: radial artery; un&a: ulnar nerve and artery. Image courtesy of Elmar Peuker.
abductor pollicis longus at the radial side and by the tendon of the extensor pollicis longus at the ulnar side.

**Important acupuncture points of the wrist region**

HT7 (Shen Men) lies radial to the tendon of the flexor carpi ulnaris muscle, at the level of the wrist crease, just proximal to the pisiform bone. The target structure of this point might be the epineural and perivascular tissue of the ulnar nerve and the ulnar artery respectively. HT7 can be needled from the volar (palmar) aspect of the wrist as well as from the ulnar aspect (parallel to the flexion crease of the wrist). LU9 lies radial to the tendon of the flexor carpi radialis muscle on the flexion crease of the wrist, lateral to the radial artery, and on the ulnar aspect of the abductor pollicis longus tendon. The perivascular tissue might be the target structure of this point as well. Puncturing of an artery by acupuncture bears a certain (though minimal) risk of causing a thrombosis. Therefore, the mentioned points should not be needled too deeply, and stimulation should be performed cautiously.

PC6 (Nei Guang) is located two cun proximal to the flexion crease of the wrist, between the tendons of the palmaris longus and flexor carpi radialis. It lies opposite TE5 (Wai Guan) which is located at the dorsal aspect of the forearm. PC7 (Da Ling) is also located between the tendons of radialis in the middle of the flexion crease of the wrist. If the palmaris longus muscle is absent, PC6 is located on the ulnar side of the flexor carpi radialis tendon. Both points overlay the median nerve, the epineural tissue of which might well be the target structure.

LI4 (He Gu) lies halfway along the line connecting the middle of the first and second metacarpals when the thumb is abducted. From investigations by means of CT, the author (EP) thinks that the target structure of LI4 is the connective tissue plane between the first dorsal interosseus muscle and the adductor pollicis muscle.

**Landmarks of the hip region**

There are some important bony landmarks with which to gauge orientation on the posterior aspect of the hip girdle. The spinous processes of L4 and L5 are quite small and often difficult to palpate. Usually the tip of the spinous process of L4 lies at the level of the most cranial extent of the iliac crests (that is the highest level in the erect posture). However, in about 20% of people the spinous process of L5 is found at this level. The

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**Figure 5** This is an axial section through the right hand at approximately the midshaft of the second metacarpal. A needle is shown penetrating the muscle of the first web space at the acupuncture point LI4. Key to labels: ap: adductor pollicis; id I: first dorsal interosseous. Image courtesy of Elmar Peuker.
supracristal plane (at the most cranial extent of the iliac crests) marks approximately the level of the intervertebral disk (L4/5), and is used as a landmark for lumbar puncture. The palpation of the iliac crest should be performed from a caudal direction. Palpation from a cranial direction might result in a layer of soft tissue padding over the crests, and therefore lead to errors in finding the intended level. The iliac crest extends from the anterior superior iliac spine to the posterior superior iliac spine. The posterior two thirds of the iliac crests are often difficult to palpate because they are covered with a thick layer of fat. The posterior superior iliac spine can be located by palpation or by inspection. It lies at the bottom of a skin dimple where the fascia and the skin are attached to the posterior superior iliac spine. Palpation of the posterior superior iliac spine should be performed from a caudal direction because the bony pole is curved caudally. A connecting line between the skin dimples marks the level of the spinous process of S2. The sacral hiatus marks the level of the fourth sacral foramen and results from the absence of laminae and the spinous process of the S5 vertebra. It can be palpated from the upper part of the intergluteal (natal) cleft. The ischial tuberosity is best palpated with the thigh flexed at the hip joint, as in extension the gluteus maximus muscle and fat cover the tuberosity. The greater trochanter can be palpated on the lateral side of the thigh approximately inferior to the iliac crest. It is usually not palpable in its whole dimension because strong muscles and fascia cover its lateral and anterior parts. However, the posterior aspect is easily detectable in most subjects.

Figure 6  This is a split level view of the posterior aspect of the pelvis illustrating some of the important anatomical landmarks and features, and four acupuncture points. Key to labels: gm: gluteus medius; sn: sciatic nerve; p: piriformis; st: sacrotuberous ligament; sh: sacral hiatus (S4 level); m: multifidus; ic: iliac crest; gmi: gluteus minimus. The black and white line marks the supracristal plane (at the most cranial extent of the iliac crests), which in this model marks the lower border of the spinous process of L4. Images courtesy of Primal Pictures Ltd. [www.anatomy.tv]
The sciatic nerve lies approximately along a line extending from midway between the posterior aspect of the greater trochanter and the ischial tuberosity to a point in the middle of the popliteal fossa. The division of the sciatic nerve into the tibial nerve and the common fibular (peroneal) nerve can occur at any level from the sciatic foramen to the upper popliteal fossa. In most cases it occurs in the distal third of the thigh. A rather common variation (present in approximately 10% of subjects) is a high division with the common fibular nerve running through the fibres of the piriformis muscle.

**Important acupuncture points of the hip region**

BL27 (*Xiao Chang Shu*) is located in a depression between the upper border of the posterior superior iliac spine and the sacrum at the level of the first sacral foramen. BL28 (*Pang Guang Shu*) lies slightly caudal to the lower border of the posterior superior iliac spine at the level of the second sacral foramen. BL36 (*Cheng Fu*) is located in the middle of the gluteal crease and therefore overlies the ischial tuberosity. The target structure at this point is probably the origin of the hamstrings, although the sciatic nerve is not far lateral to the point. BL54 (*Zhi Bian*) can be found at the level of the fourth sacral foramen (level of the sacral hiatus) about three cun lateral to the midline. At this point the first muscle layer that the needle passes through is gluteus maximus, followed by the caudal fibres of piriformis (depending on the

*Figure 7* This is a series of images illustrating the likely needle tracks at GB30 and BL54. The lower images are transverse sections through the right pelvis at two different levels, which are marked on the upper diagram for orientation. Key to labels: sn: sciatic nerve; p: piriformis; fh: femoral head; gm: gluteus maximus; sh: sacral hiatus; gme: gluteus medius; gmi: gluteus minimus. Images courtesy of Primal Pictures Ltd. [www.anatomy.tv](http://www.anatomy.tv)
size of the muscle in the individual concerned). The needle should be just inferior to the level of the sciatic nerve, but this is difficult to judge, so care should be taken to avoid unnecessary direct needling of the nerve. BL54 may represent the site of a trigger point in piriformis, although the latter may be slightly higher than BL54.

GB30 (Huan Tiao) lies on a connecting line between the sacral hiatus and the greater trochanter, somewhere between the outer and the middle third of the line. BL54 and GB30 should be needled with the patient in lateral position. The hip and knee of the treated side are flexed while the lower leg is extended. To avoid unnecessary needling of the sciatic nerve at BL54 and at tender/trigger points just superior to it, the practitioner can judge depth by placing a needle onto the edge of the sacrum just medial to the point. When subsequently needling the intended point in the sciatic notch (BL54 or above), the depth of needling should be no more than about 15mm further than the needle placed onto the edge of the sacrum. When needling at GB30 with the patient correctly positioned, the sciatic nerve is unlikely to lie on the track of the needle. The angulation of needling should be towards the symphysis pubis, and the intended depth of stimulation is the deep muscle layer (probably piriformis) just before the needle tip reaches the acetabular margin.

Landmarks of the knee region
The patella forms the anterior aspect of the knee. On the sides of the knee the lateral and medial condyles and epicondyles of the femur are subcutaneous and can easily be palpated. The tibial tuberosity lies about 4 to 6cm distal to the apex of the patella. The patella and tibial tuberosity are connected by the strong patellar ligament. The tibial condyles can be palpated on both sides of the patellar ligament. The head of the fibula can be palpated at the level of the upper border of the tibial tuberosity. It is easy to find by following the tendon of the biceps femoris muscle which inserts at the head of the fibula.

The popliteal fossa is framed by several muscles. The semimembranosus forms the superior medial border of the popliteal fossa. The thick cord-like tendon of the semitendinosus is clearly palpable at the medial side overlying the semimembranosus. The gracilis overlies the semimembranosus as well, but it lies more medial than the semitendinosus. It is best palpated as a band-like structure with the knee flexed and foot internally rotated. The superior lateral border of the popliteal fossa is formed by the biceps femoris, which is best palpated with the knee flexed and foot externally rotated. The gastrocnemius represents the lower border of the popliteal fossa, and is usually only palpable as an indistinct mass.

The popliteal vessels enter the fossa about halfway along the superomedial border (after leaving the adductor canal) and run downwards to the middle of the fossa. The common fibular nerve takes its course from the upper angle of the popliteal fossa, downwards under the inner border of the biceps femoris muscle, and onto the neck of the fibula where it becomes palpable. The tibial nerve runs from the superior to the inferior angle of the popliteal fossa and usually lies superficial to the popliteal vessels.

Figure 8 This is a composite view of the right popliteal fossa illustrating the main nerves and vessels, and the location of three acupuncture points. Key to labels: sm: semimembranosus; st: semitendinosus; fn: fibular (peroneal) nerve; tn, pv: tibial nerve, popliteal vessels. Image courtesy of Elmar Peuker.
Important acupuncture points of the knee region

With the knee flexed, ST34 (Liong Qiu) lies two cun above the superiolateral margin of the patella. It often overlies a depression in the vastus lateralis muscle. On the medial side, two cun proximal to the superiomedial border of the patella lies SP10 (Xue Hai). At the lower border of the patella (with the knee slightly flexed), and lateral to the patellar ligament, ST35 (Du Bi) is located. This location roughly represents one of the common arthroscopic approaches to the knee joint. Thus, ST35 (and EX-LE5 on the other side of the patellar ligament) should not be needled too deeply. ST36 (Zu San Li) is one of the most frequently treated acupuncture points. It lies at the level of the lower border of the tibial tuberosity, about three cun below ST35 and one fingerbreadth lateral to the tibial edge. In most people a clearly palpable depression in the anterior tibial muscle can be found at this location.

GB34 (Yang Ling Quan) is also located at the lateral side of the knee. It can be found in a depression in front of and below the head of the fibula. It overlies the upper border of the common fibular (peroneal) nerve which winds around the fibular neck. Two cases have been reported where acupuncture treatment at GB34 led to a complete paralysis of the fibular nerve and foot-drop.1;2 One case of acute compartment syndrome, which appears to have resulted from needling in this area, has been reported in a patient who was taking warfarin.3 It is not clear whether the point implicated was GB34 or ST36, but it is likely to have resulted from direct needling of the anterior tibial artery, and this vessel can probably be reached more easily at GB34.

At the level of the lower border of the tibial tuberosity on the medial side of the knee, SP9 (Yin Ling Quan) is located. It can be found in a depression distal to the medial condyle of the tibia.

Figure 9. This is an axial section of the right lower leg at the level of the neck of the fibula, illustrating the large vessels and nerves, and the positions of two acupuncture points. Key to labels: ta: tibialis anterior; cfn: common fibular (peroneal) nerve; f: fibula; pv: popliteal vessels; tn: tibial nerve. The anterior tibial artery is not clear on this section. It lies about 1cm beyond the tip of the needle at GB34. Note also the proximity of this needle to the common fibular nerve. ST36 is a much safer point into the bulk of tibialis anterior from the anterior aspect of the leg. It lies slightly below the level illustrated. Image courtesy of Elmar Peuker.
in front of the belly of the gastrocnemius muscle.

BL40 (Wei Zhong) is located on the dorsal side. It lies in the middle of the popliteal fossa and overlies the popliteal vessels and the tibial nerve, which may be reached at 2 to 3 cm depth. There have been several case reports on lesions of the tibial nerve and the popliteal vessels by acupuncture. 4,5

Landmarks of the ankle region and the foot
The lateral and the medial malleolus are subcutaneous and easy to palpate. The tip of the lateral malleolus extends approximately 1 cm further distally and more posteriorly than the tip of the medial malleolus. The fifth metatarsal bone has a prominent tuberosity at its base, which serves as a landmark for the level of the tarsometatarsal joint line. On the medial side, the tuberosity of the navicular and the medial cuneiform can be palpated quite easily inferior and anterior to the tip of the medial malleolus.

The soleus and the gastrocnemius have a common tendon, the calcaneal tendon (Achilles tendon), which attaches to the calcaneus and is an important landmark at the posterior aspect of the ankle.

The tendon of tibialis posterior runs around the medial malleolus and can be palpated when the foot is inverted. It inserts at the tuberosity of the navicular bone. Behind the tendon of tibialis posterior run the tendons of flexor digitorum longus and flexor hallucis longus.

Halfway between the medial malleolus and the Achilles tendon, the pulse of the posterior tibial artery can be palpated as it runs behind and under the malleolus. The tibial nerve lies slightly posterior to the artery.

On the lateral side of the ankle, the peroneus longus and brevis tendons run behind and under the malleolus. There is no big artery in this region, but close to the tip of the malleolus the sural nerve and the short saphenous vein are located.

The dorsal pedis artery lies directly lateral to the tendon of extensor hallucis longus, and runs towards

Figure 10 This is an axial section through the right ankle at the level of the malleoli. Key to labels: f: fibula; at: Achilles tendon; tn,ptv: tibial nerve, posterior tibial vessels; t: tibia; tl: talus. Note that the anterior tibial artery and the deep fibular (peroneal) nerve are not labelled. They lie at the tip of the needle labelled ST41. Image courtesy of Elmar Peuker.
the first interdigital cleft. It is accompanied by the end branch of the deep fibular (peroneal) nerve.

**Important acupuncture points of the ankle region and of the foot**

KI3 (Tai Xi) lies in the middle of a line connecting the tip of the medial malleolus and the Achilles tendon. It overlies the so-called tarsal channel which contains the posterior tibial artery and the tibial nerve. Presumably the epineural and perivascular tissue is a target structure of this acupuncture point. KI6 (Zhao Hai) is located 0.5 cun caudal to medial malleolus. The needle reaches the deltoid ligament between the tibia and the tarsus, which is extensively innervated. KI7 (Fu Liu) lies two cun above KI3 at the anterior margin of the Achilles tendon. SP6 (San Yin Jiao) can be found three cun above the tip of the medial malleolus in an often clearly palpable depression at the posterior tibial edge. It is a rather frequently treated point, and the target structure may be the connective tissue planes between the flexor muscles of the calf.

BL60 (Kun Lun) lies approximately halfway along a line between the tip of the lateral malleolus and the Achilles tendon. BL62 (Shen Mai) is located in the depression directly below the tip of the lateral malleolus.

ST41 (Jie Xi) lies in the anterior middle of the connecting line between the tips of the medial and lateral malleolus. It is located between the tendons of the long extensor muscles of the great toe, and the toes. It overlies the anterior tibial artery (as it becomes the dorsalis pedis) and the deep fibular (peroneal) nerve.

LR3 (Tai Chong) lies between the first and second metatarsals. It overlies the dorsal pedis artery and the end of the deep fibular (peroneal) nerve.

**Conclusion**

The authors believe that an acupuncturist should always know where the tip of their needle lies with respect to the relevant anatomy, so that vital structures can be avoided and so that the intended target for stimulation can be reached.

**Reference List**
