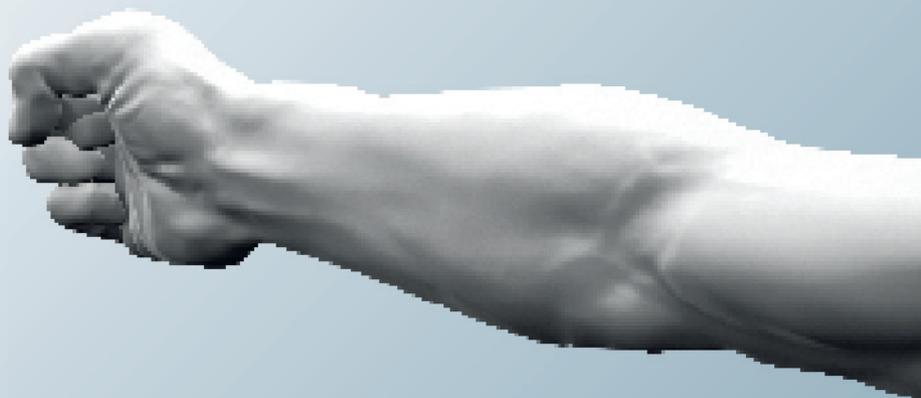


TUTORIALS

TECHNIQUES / TIPS / TRADE SECRETS



ZBRUSH body work

Muscle, bone and sinew: in the first of this issue's three masterclasses on modelling the human body, we explain how to recreate the fine details of the torso and arms of the male figure shown on the right **BY SCOTT EATON**

FACTFILE

FOR
ZBrush

DIFFICULTY
Advanced

TIME TAKEN
Two days

ON THE CD

- Sequential OBJ files showing the model at intermediate stages
- Final ZTL file

ALSO REQUIRED

Annotated full-size screenshots can be found on the Stop Press section of our website www.3dworldmag.com

From this point forward, consider yourself a sculptor, not simply a CG modeller. As with the old masters, familiarising yourself with your tools is only half the job. The other half consists of the never-ending process of developing your artistic skill - which is where anatomical study comes in.

This tutorial sets out the anatomical considerations that went into sculpting the torso and arms of the model on the right. While this detailed work was carried out in ZBrush, the figure was first roughed out and posed as a low-resolution mesh within Maya. This base mesh has been included on the CD for you to load in at the start. Note that it has no symmetry, which means that you will have to sculpt both sides independently. This may seem frustrating, but it will encourage you to consider lateral variations in pose, balance and tension.

The tutorial has been broken down into several sections, each covering a single part of the body. This is different to my own ZBrush workflow, since I always sculpt the entire model at each level of subdivision before moving on to the next. The steps have been arranged out of chronological order in the

walkthrough to make better anatomical sense, but you can follow them in any logical sequence you choose.

To help you along, an OBJ of the model at each level of subdivision is provided on the CD. If you lose your way at any point, you can import the OBJs to get you back on track. Better still, as you tackle each new level of subdivision, delete any current morph targets, store your current unrefined level as a new morph target, and import the OBJ into the current level. You can then switch back and forth between the reference model and the one you're working on.

From a ZBrush standpoint, there are very few tools and settings to cover. The entire model was created with the Standard brush in Move or Draw mode, occasionally altering the focal shift. All you need to follow the tutorial is a basic familiarity with the software - and, ideally, a good anatomy reference book. You can find a list on page 55 of the magazine.

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● This detailed anatomical model of an archer, minus bow, was originally created as a low-resolution mesh in *Maya* and rigged and posed before export to *ZBrush*. Overleaf, discover how the fine detail of the arms and torso was sculpted



GO ONLINE
● The Stop Press section of our site contains bonus tutorial files



STAGE ONE | Preparing the low-resolution mesh for sculpting



01 Start *ZBrush* and import *archer_baseModel.obj*. We'll begin by dividing the model into subgroups. Using the Show/Hide controls - [Ctrl]+[Shift]-drag - hide a section of the model at a time. Once you have a decent selection, use Polygroups > Group Visible to set the group. Repeat until you have a set-up similar to the one above.



02 Begin by lining up the edge loops with major anatomical features, as shown above. This model is quite blocky, and many of the edge loops need to be adjusted to flow more precisely along the desired contours. At this stage, you're only looking to establish the major forms of the figure, not the fine details

EXPERT TIP

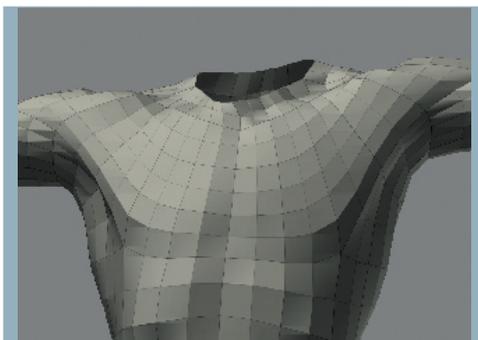
Keep it simple

When making a model for export to *ZBrush*, simple is better. A coarse control cage allows key proportions to be adjusted more easily. Try to make all the polygons quads, and as close to square as possible. This keeps the subdivision uniform. Once in *ZBrush*, always work at the appropriate level of subdivision for the details you're putting in, and sculpt each level of subdivision to completion. If you need to modify a larger shape, step down in subdivision level until you can do so with one or two vertex adjustments.

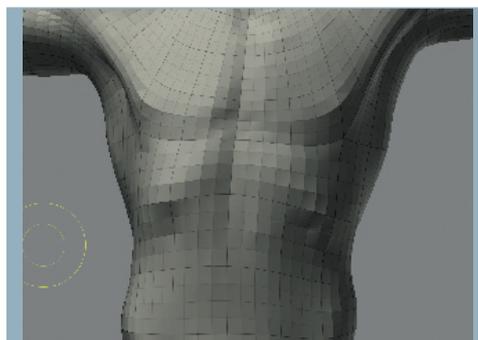
STAGE TWO | The front of the torso



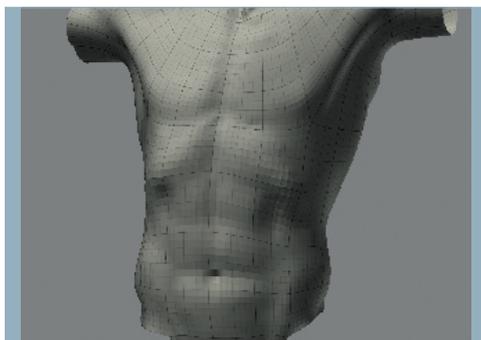
03 Step back to Subdivision Level 1 and line up edge flow more accurately by locating key bony points on the front of the body. The critical landmarks are: the points of the pelvis, level of the fifth rib, pit of the neck, sternum and clavicles. Use your anatomy reference to help locate them, then use the Move tool to position your edges. The edges serve as boundaries for the muscles in the region.



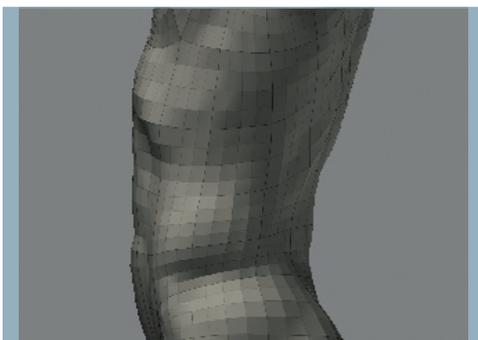
04 Next, you need to establish the edge flow around the chest and shoulders. The front of the upper half of the torso is dominated by the pectoral muscles (pecs). Each muscle originates from the centre line of the body at the sternum (breastbone), is bordered above by the clavicles and below at the level of the fifth rib, and wraps up and inserts underneath the deltoids (shoulder muscles).



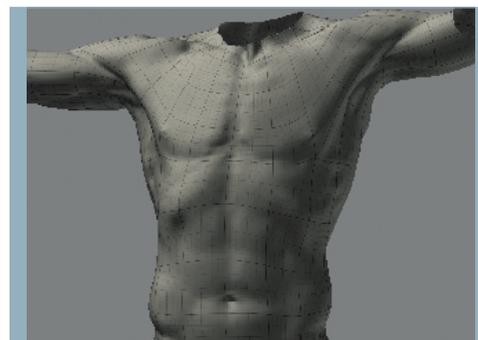
05 Now block in the ribcage. Just below the bottom of each pectoral muscle is the opening of the ribs. In males, the angle formed by the opening can approach 90 degrees, and it spirals down and around the side of the body. Remember that the ribs are usually covered by thin muscles, so their form is rarely overly defined. Try to indicate the arch of the ribs at Subdivision Level 3.



06 Rough in the limits of the abdominal muscles (abs) next. In this pose, the abs are stretched thin and don't bulge out as they would if they were flexed. They attach just below the pecs and extend down to the floor of the pelvis, vertically filling the middle third of the torso. You may have to step up to Level 4 to get a dense enough mesh to work with.



07 At either side of the abs lie the external obliques. These muscles sit just above the crest of the pelvis and have a distinctive teardrop shape as they wrap around the side of the body. Their mass is greatest just above the hips, where they help to bend the torso side to side. Here, the torso is balanced so that both sides have roughly equal shape.



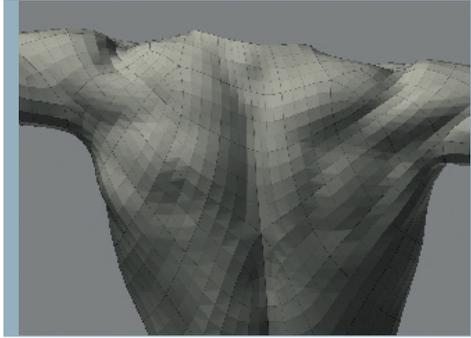
08 Levels 4 and 5 are where you refine the masses of the torso and define transitions between muscle groups. At this stage, you need to refine the separation between the abdominal muscles. In addition, the attachment of the pecs to the sternum can be sharpened, and their sweep over and into the upper arm can be refined.



STAGE THREE | The back of the torso



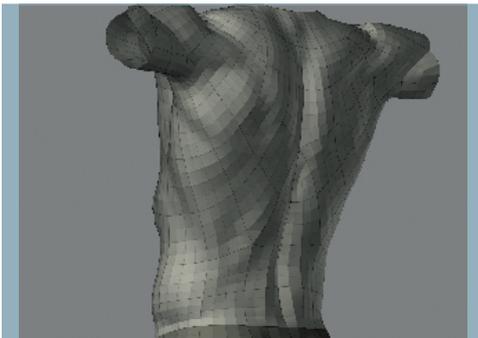
09 Next, the bony landmarks and edge flows of the back need to be established at Level 1. The upper back is dominated by the ever-mobile scapula, which has a diagonal spine running inward from the shoulders. The lower edge of the ribcage creates a sharp change of plane and should be placed at approximately two thirds of the way down the back.



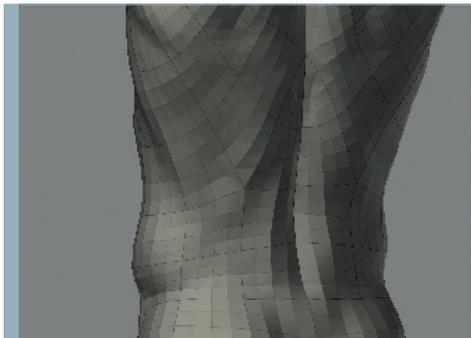
10 Step up to Level 3 and turn your attention to the shapes of the scapula. Notice that the arms are roughly at the same elevation, yet are not perfectly symmetric. The result is a subtle difference in the rotation of the scapulae. Locate the spine of the scapula on your model, and, using your anatomy book, cross reference the forms you see here with an anatomy plate showing the back.



11 The trapezius muscle dominates the area above the spine of the scapula. It has a kite-like shape that descends downwards to a tail halfway down the back. This muscle lies on top of all the others in the region. Also, note the prominence of the seventh cervical vertebra, which lies at the top of the thorax and sits in the middle of a flattened tendinous expansion of the trapezius muscle.



12 The other major muscle here is the latissimus dorsi: a large flat muscle that covers the lower half of the back. It starts at the spine and sweeps up towards its insertion on the upper arm. It gets thicker approaching the sides and armpit, but is often stretched so thin on the back that the lower two or three ribs are subtly revealed.



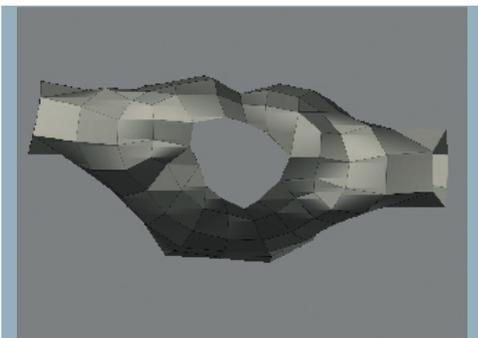
13 As the obliques (see Step 7) spiral up towards the bottom of the ribcage, they just make it into the back view. Where the obliques fade out, the muscles of the lower back, the spinal erectors, take over. These form two columns on either side of the spine that reach up and connect the pelvis to the ribcage and vertebrae.

EXPERT TIP

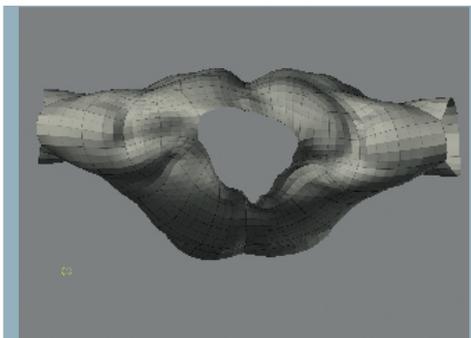
Muscle over bone

Understanding what lies beneath the muscles is critical to maintaining a believable sense of volume. Always keep track of how the bones are influencing the muscular and surface forms above them. On the back, for example, mentally visualise the egg-like shape of the ribcage, with its unique contours, then consider how thick the muscular masses are that run over the top of it. This will enable you to accurately sculpt the ribs showing through where the back muscles are thin, and the muscles bulging where there's more mass.

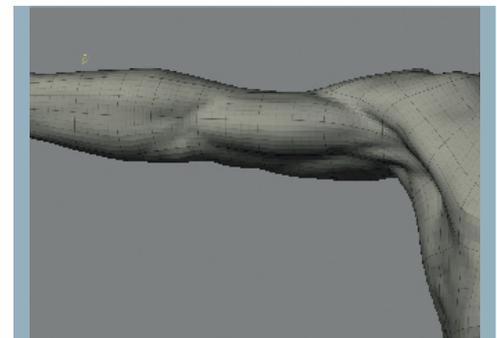
STAGE FOUR | Upper arms and shoulders



14 For the upper arms and shoulders, establish the contours of the clavicles (collarbones) and shoulders from an overhead view. The clavicles carve out an elongated shape and meet the spine of the scapula at the point of the shoulder. The two converge, clamp-like, on the ribcage. Move your Level 1 edges to create contours similar to those shown above.



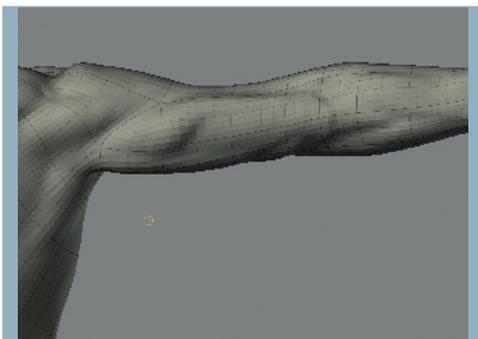
15 The big shoulder muscles are the deltoids. There are three distinct bodies to the deltoids: one in the front that attaches into the outer third of the clavicle, one in the middle that attaches to the acromion process (the point of the shoulder), and a rear head that attaches into the lower border of the scapula. The three heads converge into a common point on the top half of the upper arm.



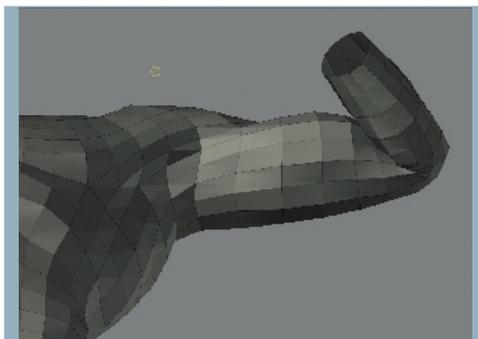
16 Use Level 4 to show more detail. On the front of the extended arm, the biceps (the main muscle of the upper arm) is stretched thin. From this view, you can see how the biceps interlocks with the deltoid muscles as it connects to the armpit. In this pose, the biceps is fully extended and has a long tubular shape. Also note the other small muscle that extends down into the armpit.



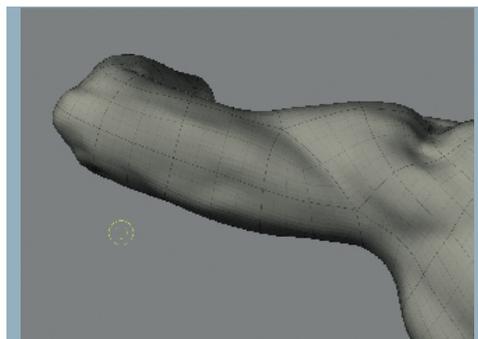
STAGE FOUR (Continued) | Upper arms and shoulders



17 The back view shows the shape of the triceps muscle in tension. The triceps, as its name implies, has three heads. The two most visible are the short and the long head; the middle head only shows at the very end, near the elbow. Separating the two main heads is a tendinous sheet that gives the muscle its 'horseshoe' appearance when it is flexed.

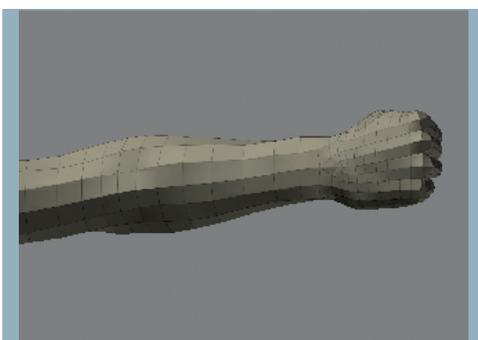


18 This image of the flexed left arm shows how much shape should be established at low levels of subdivision. For this arm, two levels are enough to almost entirely establish the shape. The higher levels of subdivision are only used to subtly indicate the separation between biceps and triceps.

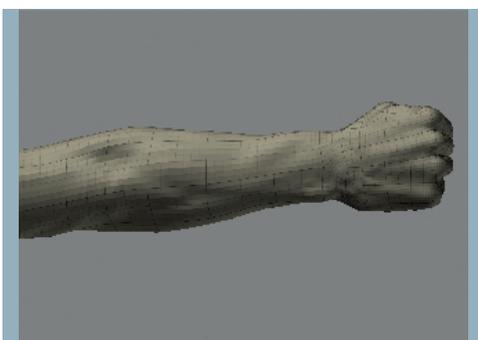


19 With most of the shape of the arm established, Subdivision Level 5 is used to indicate soft details on the triceps, stretched thin in this pose. On certain occasions, less is more when it comes to muscle definition. Varying the amount of detail based on the actual tension in the muscles helps to give the model a more 'natural' feel.

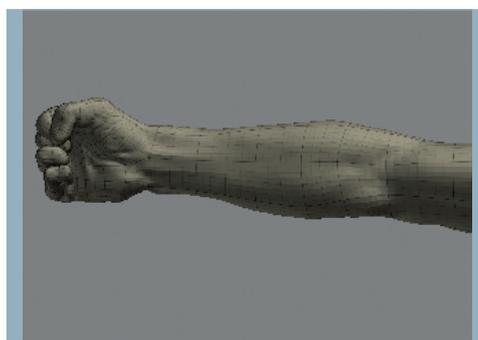
STAGE FIVE | Forearms



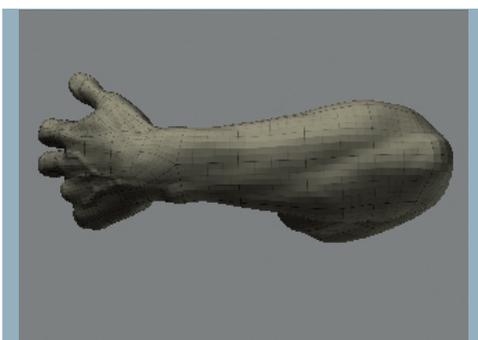
20 There are two main muscular masses to the forearm: the flexor muscles and the extensors. Both sets of muscles clamp onto the distal end of the humerus (the elbow end of the upper arm bone). This gives the forearm a characteristic flare around the elbow. With the mesh at Level 2, identify and sculpt in these contours.



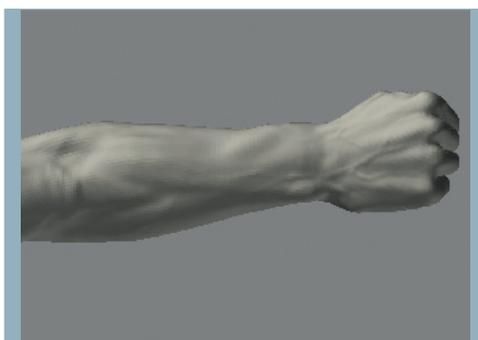
21 Once the main mass is established, the extensor muscles can be refined. This collection of muscles originates from the outside of the elbow and runs diagonally across the back of the forearm and down to the wrist. Some of these muscles control the fingers, others the wrist. At Level 4, try to indicate this diagonal mass.



22 The flexor muscles run across the front of the forearm. They originate at the inner side of the elbow and spiral forward and down to the wrist. They're met above by a rogue mass of extensor muscles that creep towards the front of the wrist. This creates two competing masses that vie for space on the front of the arm.



23 The same construction applies to the flexed arm. There is, however, a difference in form that results from the biceps pushing against the forearm muscles, causing them to bulge above and below. Attention to these details is critical to making the pose and the anatomy hold together.



24 Again, it's important to understand the structure underneath the muscles. The two bones of the forearm are the radius and ulna. These two bones provide important surface landmarks on the forearm. The ulna, on the pinky finger side, gives the familiar bump just before the wrist. At the other end, the ulna expands and thickens to give the hard point of the elbow.

EXPERT TIP

Fighting forces

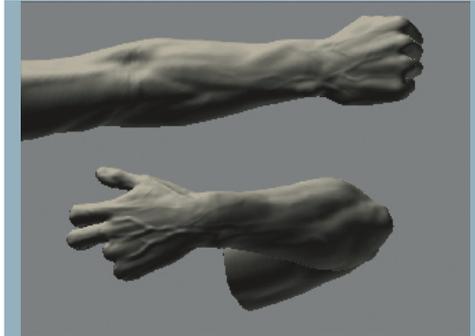
Consider tension vs relaxation in each pose you sculpt. Each part of the body is fighting gravity, either balancing the downward force with skeletal or muscular tension. Similarly, if there's something dynamic going on in the pose, muscles must be tensed to balance these forces. This pose was conceived to show the back muscles under tension, resisting the pull of the imaginary bow. To counter this tension, in the front, the pectoral muscles are relaxed and stretched. They would have a different form if they were actively resisting a force.



STAGE SIX | Details and finishing



25 Subdivide to Level 6. Using the Standard brush, set the Focal Shift to 40-50 to get a good cutting tip. Start to accent transitions that should be sharper. Most of these transitions take place where muscle attaches directly to bone. In this pose, the sharpest transitions are where the pecs meet the sternum and where the deltoid originates at the point of the shoulder.



26 Only when you're happy with the overall shape of the model should you consider adding veins and fine details like this. Veins are somewhat tricky, because their form varies quite a bit from individual to individual. There's a structure to how they branch out from the main tributaries closer to the body. To capture this, consult an anatomy reference or observe a live model.

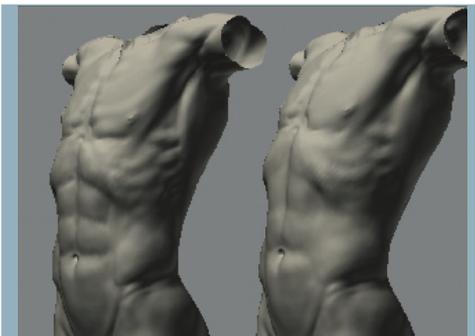
EXPERT TIP

Diagnostic tricks

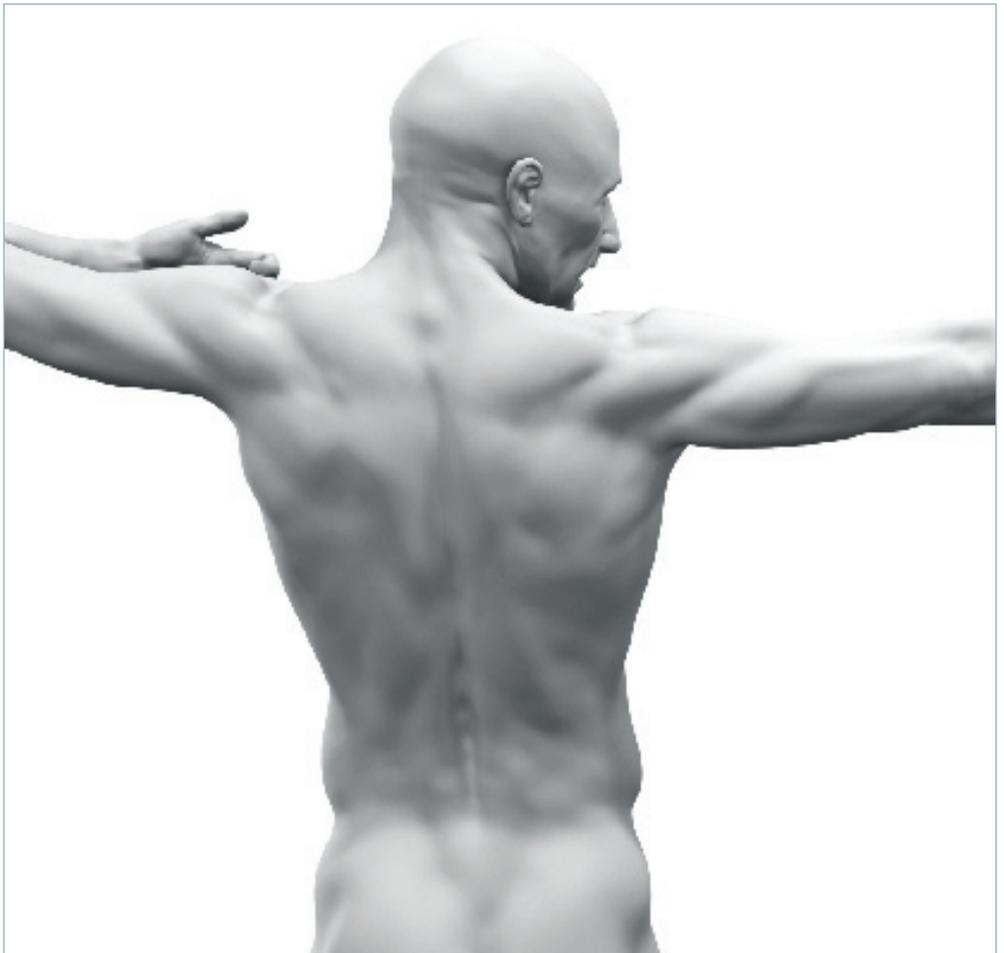
Lighting is vital when diagnosing problems with a model. Move your lights around so that they illuminate it from above and below at all possible angles. Each new position is like a fresh view. Another nice tool is specularity. When the subdivisions get high, consider switching to a more specular shader. Tight specular highlights rolling over the surface of your model will help to show up small surface imperfections that are not readily visible with a diffuse shader. This also helps to show how well your forms are transitioning from one to another.



27 Inevitably, small bumps will infiltrate your higher subdivisions. To help diagnose imperfections, a specular material helps. Set your surface material to BasicMaterial and turn the Specularity up to 30-40. Use the Smooth brush at a high level of subdivision to help eliminate the imperfections.



28 It's easy to over-model a figure, especially since *ZBrush* makes it so easy to put details in. When it comes to muscular details, a little restraint can go a long way. Not every detail that you see in an anatomy plate needs to be translated onto your model. There's a time for power and a time for subtlety, so allow the pose and the action to dictate.



29 To conclude, let's run back through the points that are critical to success in figurative modelling work. First, underlying proportions are everything. Make sure your base model is well put together before starting the musculature. Next, block in the large muscular forms, but always consider the skeleton underneath as you work - and only when the large muscular forms are in place should the

small muscular forms go in. After this, you're free to sculpt the fine details, such as veins and tendons. This approach of working 'from biggest to smallest' fits perfectly with *ZBrush's* multi-resolution modelling capabilities. The toolset and technique work beautifully together and, when combined with a guiding artistic vision, the results will speak for themselves. ●