Chapter 8. Creating Organic Materials

In this chapter, we will cover the following topics:

- Creating an organic-looking shader with procedurals
- Creating a wasp-like chitin material with procedural textures
- Creating a beetle-like chitin material with procedural textures
- Creating tree shaders – the bark
- Creating tree shaders – the leaves
- Creating a layered human skin material in Cycles
- Creating fur and hair
- Creating a gray alien skin with procedurals

Introduction

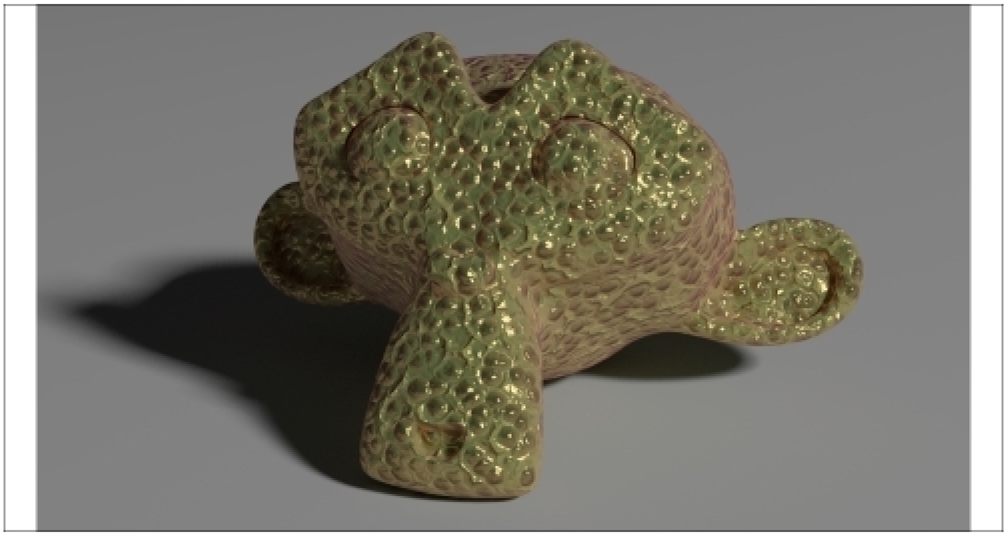
Following on from the natural materials we have seen in Chapter 3, *Creating Natural Materials in Cycles,* and in Chapter 5, *Creating Complex Natural Materials in Cycles*, it's now time to take a look at organic shaders.

Once again, while building the materials, we tried to use only the Cycles procedural textures. In several cases, this hasn't been the case by the way: on one side, because it hasn't been possible, and on the other side, because image maps usually work better than procedurals.

In any case, procedurals have often been added to the shader to refine the details or to add a natural-looking randomness to a pattern that repeats too much.

Creating an organic-looking shader with procedurals

In this recipe, we will create a sort of organic, disgusting-looking material, as shown in the following screenshot:



The disgusting organic material as it appears in the final rendering

Getting ready

Start Blender and open the `9931OS_08_start.blend` file, where there is an already set scene with an unwrapped **Suzanne** primitive object leaning on a Plane, an Emitter mesh-light, and a Camera.

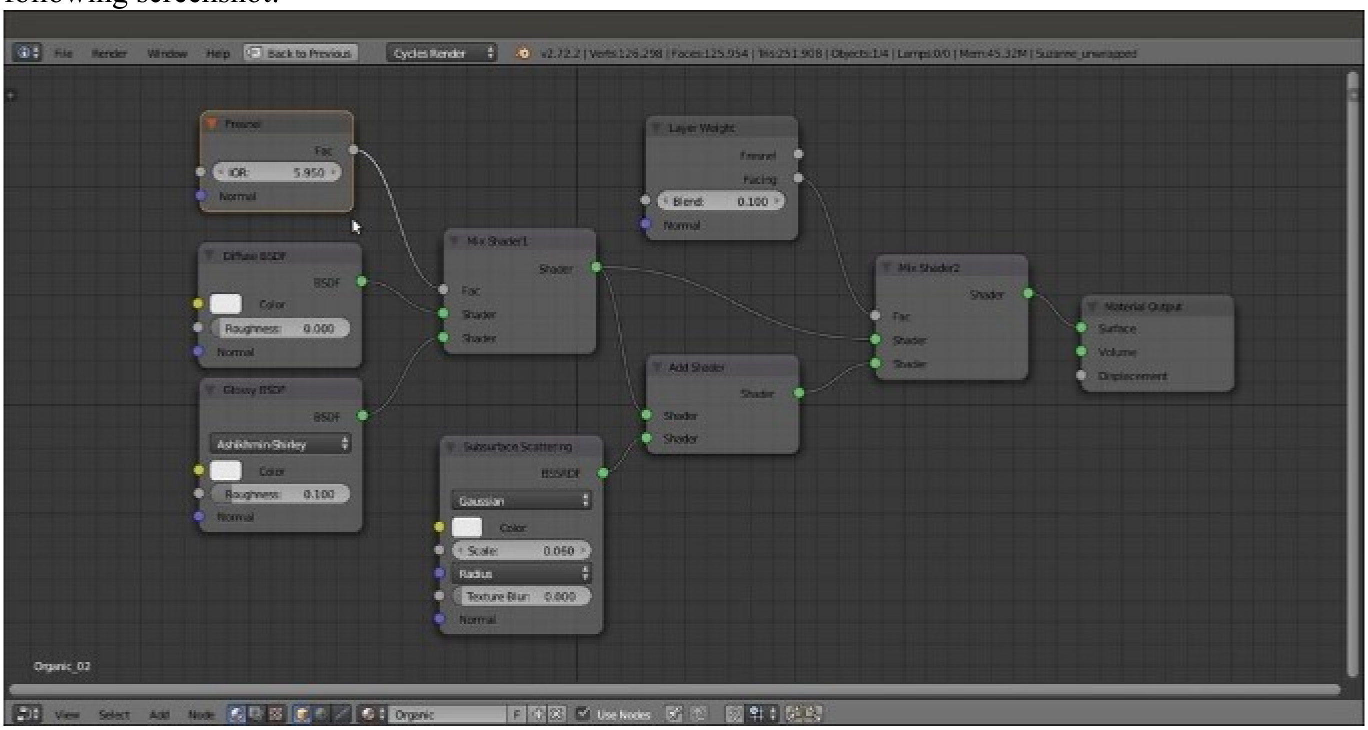
Go to the **Render** window, and in the **Sampling** subpanel, change **Pattern** from **Sobol** to **Correlated Multi-Jitter**.

How to do it...

Let's go straight to the material creation by using the following steps:

1. Click on the **New** button in the **Node Editor** window toolbar or in the **Material** window under the main **Properties** panel and rename the new material `Organic`.
2. In the **Material** window, switch the **Diffuse BSDF** shader with a **Mix Shader** node, and label it as `Mix Shader2`. In the first **Shader** input socket, select a **Mix Shader** node and label it as `Mix Shader1`, and in the second one, select an **Add Shader** node.
3. Go to the **Mix Shader1** node, and in the first **Shader** input socket, load a **Diffuse BSDF** node, and in the second one, load a **Glossy BSDF** node. Change the **Glossy BSDF** shader node's **Distribution** to **Ashikhmin-Shirley**, and set the **Roughness** value to `0.100`.

4. Add a **Subsurface Scattering** node (press *Shift* + *A* and navigate to **Shader** | **Subsurface Scattering**). Set the **Falloff** value to **Gaussian**, the **Scale** value to `0.060`, and the **Radius** values to `4.000`, `2.000`, and `1.000` (top to bottom).
5. Connect the **Mix Shader1** output to the first **Shader** input socket of the **Add Shader** node, and the output of the **Subsurface Scattering** node to the second **Shader** input socket of the **Add Shader** node.
6. Add a **Layer Weight** node (press *Shift* + *A* and navigate to **Input** | **Layer Weight**) and connect its **Facing** output to the **Fac** input socket of the **Mix Shader2** node. Set the **Blend** value to `0.100`.
7. Add a **Fresnel** node (press *Shift* + *A* and navigate to **Input** | **Fresnel**) and connect its output to the **Fac** input socket of the **Mix Shader1** node. Set the **IOR** value to `5.950` as shown in the following screenshot:

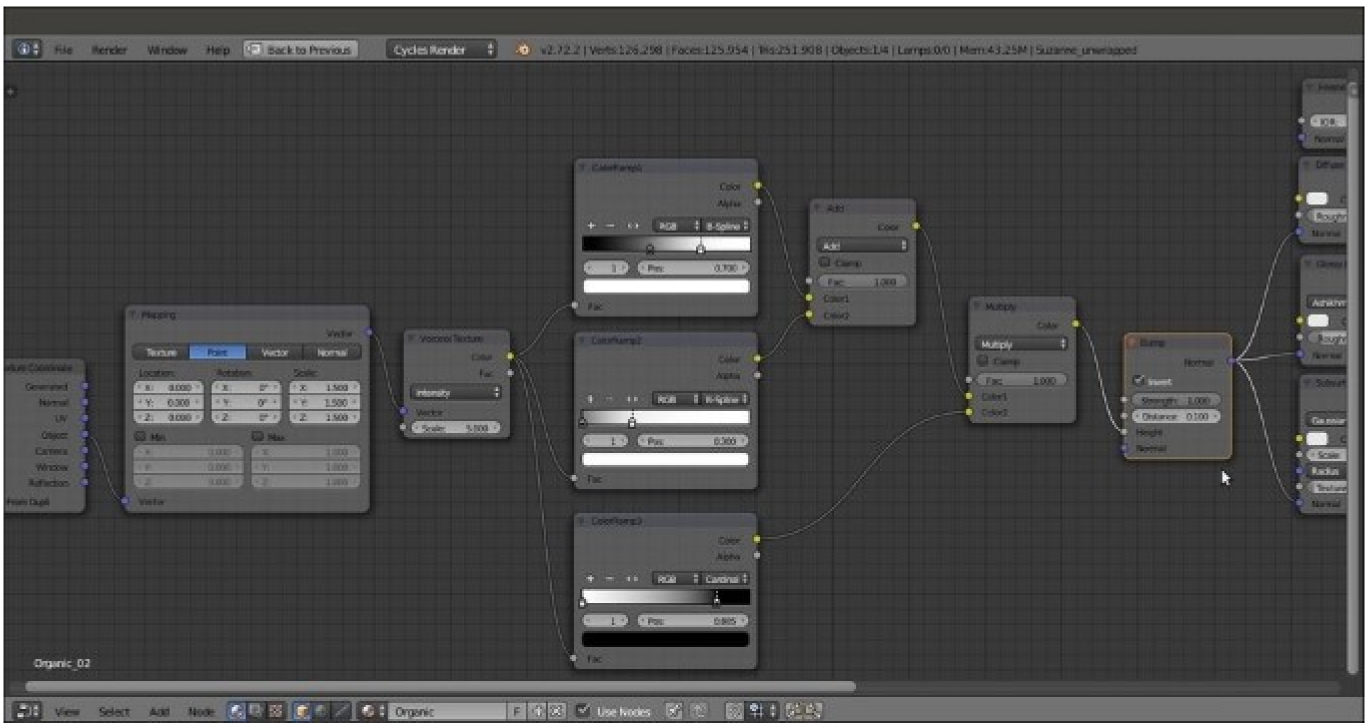


The basic shader nodes

8. Add a **Texture Coordinate** node (press *Shift* + *A* and navigate to **Input** | **Texture Coordinate**), a **Mapping** node (press *Shift* + *A* and navigate to **Vector** | **Mapping**), and a **Voronoi Texture** node (press *Shift* + *A* and navigate to **Texture** | **Voronoi Texture**). Connect the **Object** output of the **Texture Coordinate** node to the **Vector** input socket of the **Mapping** node, and the output of this to the **Vector** input of the **Voronoi Texture** node. Set the **Scale** value of the **Mapping** node to `1.500` for the three axes.
9. Add three **ColorRamp** nodes (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**) and label them as `ColorRamp1`, `ColorRamp2`, and `ColorRamp3`. Connect the **Color** output of the **Voronoi Texture** node to the **Fac** input sockets of the three **ColorRamp** nodes.
10. In the **ColorRamp1** node, set **Interpolation** to **B-Spline**, the black color stop to the `0.400` position, and the white color stop to the `0.700` position. In the **ColorRamp2** node, set

Interpolation to **B-Spline** as well. Leave the black color stop at the `0.000` position, and move the white color stop to the `0.300` position. In the **ColorRamp3** node, set **Interpolation** to **Cardinal**, leave the black color stop at the `0.000` position, and move the white color stop to the `0.805` position.

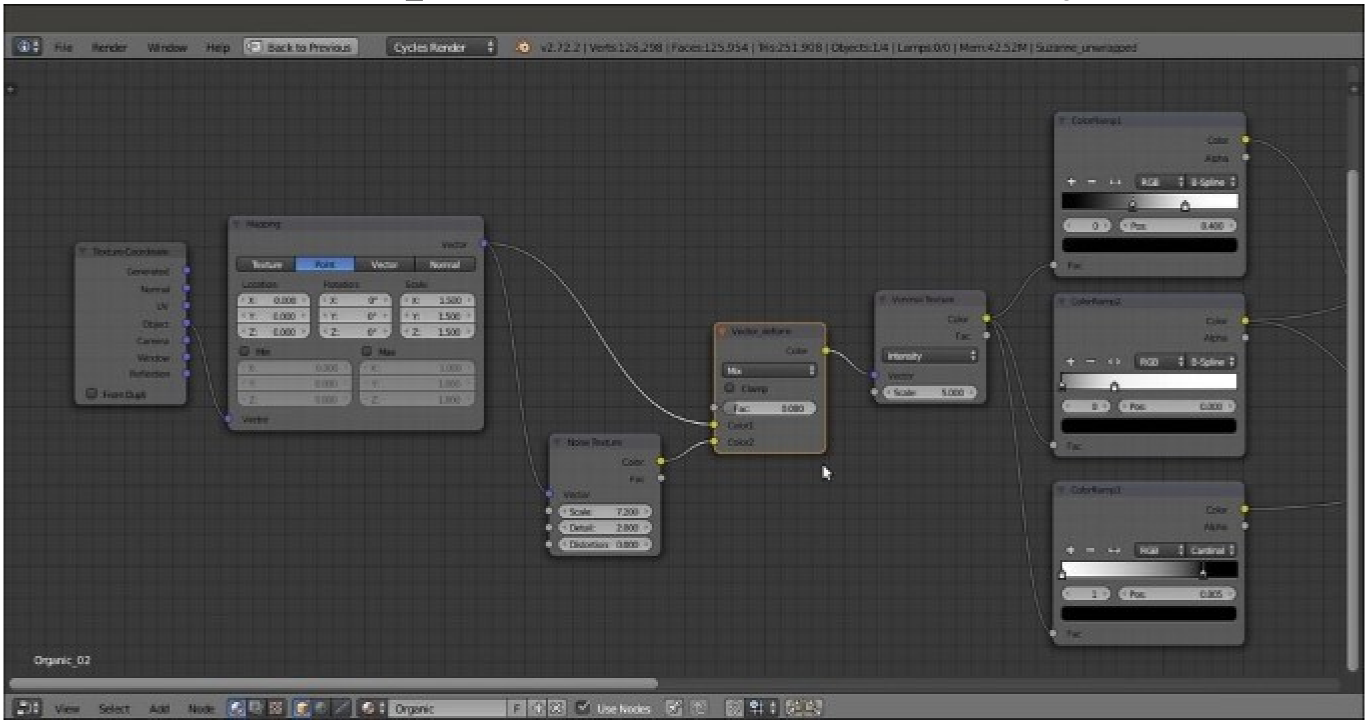
11. Add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**), set **Blend Type** to **Add** and the **Fac** value to `1.000`, and then connect the **Color** output of the **ColorRamp1** node to the **Color1** input socket, and the **Color** output of the **ColorRamp2** node to the **Color2** input socket.
12. Press *Shift* + *D* to duplicate the **Add** node and change **Blend Type** of the duplicate to **Multiply**. Connect the output of the **Add** node to the **Color1** input socket, and the **Color** output of the **ColorRamp3** node to the **Color2** input socket.
13. Add a **Bump** node (press *Shift* + *A* and navigate to **Vector** | **Bump**) and connect the output of the **Multiply** node to the **Height** input socket of the **Bump** node. Connect the **Normal** output of this to the **Normal** input sockets of the **Diffuse BSDF**, **Glossy BSDF**, and **Subsurface Scattering** nodes. Enable the **Invert** option on the **Bump** node, as shown in the following screenshot:



The Bump node

14. Now, box-select (press the *B* key) the **Texture Coordinate** node and the **Mapping** nodes, and move them to the left to make room for new nodes.
15. Add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**) and label it as `Vector_deform`. Paste it between the **Mapping** and **Voronoi Texture** nodes.
16. Add a **Noise Texture** node (press *Shift* + *A* and navigate to **Texture** | **Noise Texture**), connect to its **Vector** input socket the **Mapping** node output, and set the **Scale** value to `7.200`. Connect

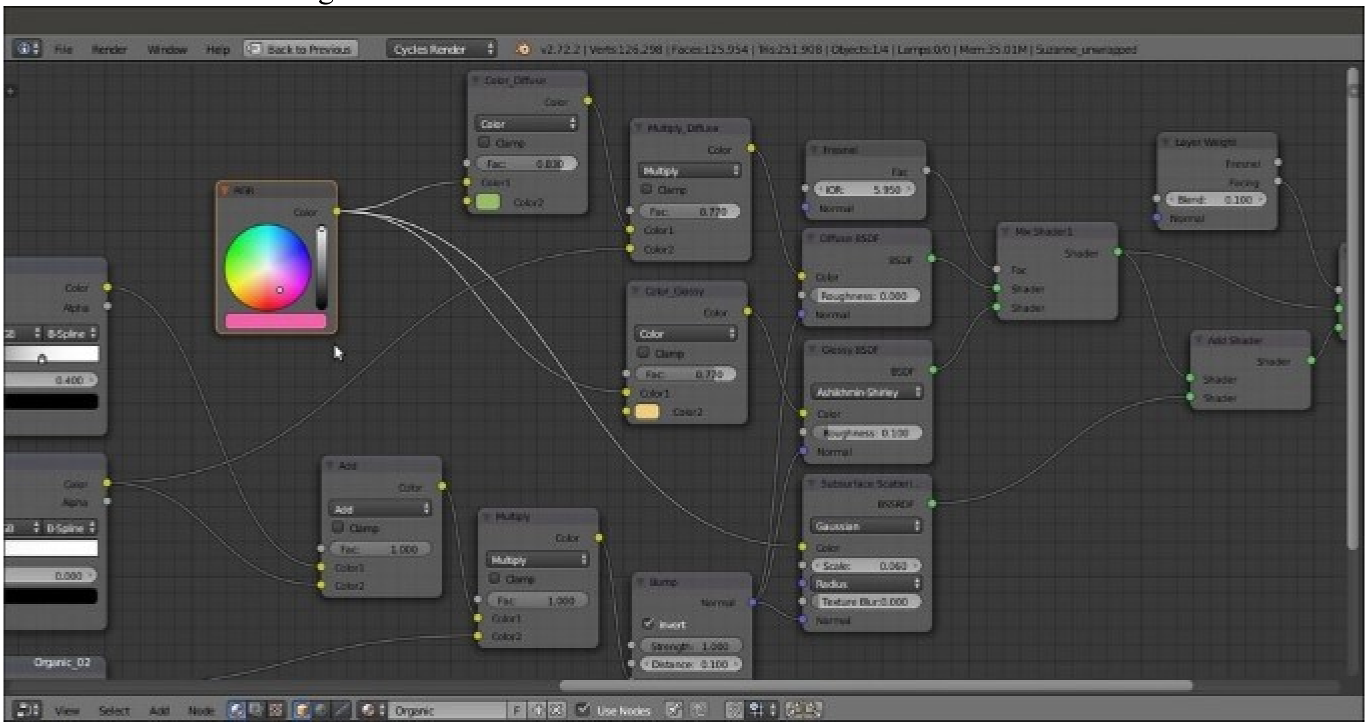
the **Noise Texture** node's **Color** output to the **Color2** input socket of the **Vector_deform** node. Set the **Fac** value of the **Vector_deform** node to `0.080`, as shown in the following screenshot:



Deforming the mapping coordinates of the bump textures through a procedural noise

17. Add an **RGB** node (press *Shift* + *A* and navigate to **Input** | **RGB**) and a new **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**). Label the **MixRGB** node
18. as `Color_Diffuse`.
19. Press *Shift* + *D* to duplicate the **Color_Diffuse** node and label the duplicate as `Color_Glossy`.
20. Connect the **Color_Diffuse** node's output to the **Color** input socket of the **Diffuse BSDF** shader node, and the **Color_Glossy** node's output to the **Color** input socket of the **Glossy BSDF** shader node.
21. Connect the output of the **RGB** node to the **Color1** input sockets of both the **Color_Diffuse** and **Color_Glossy** nodes. Connect the **RGB** node also to the **Color** input socket of the **Subsurface Scattering** node.
22. Press *Shift* + *D* to duplicate the **Color_Diffuse** node, set **Blend Type** of the duplicate to **Multiply**, and label it as `Multiply_Diffuse`; then, paste it between the **Color_Diffuse** and **Diffuse BSDF shader** nodes.
23. Connect the **Color** output of the **ColorRamp2** node to the **Color2** input socket of the **Multiply_Diffuse** node. Set the **Fac** value of this to `0.770`.
24. Go to the **Color_Diffuse** node and set the **Fac** value to `0.830`, and change the **Color2** value of **R** to `0.315`, **G** to `0.500`, and **B** to `0.130`.
25. Go to the **Color_Glossy** node and set the **Fac** value to `0.770`, and change the **Color2** values of **R** to `0.860`, **G** to `0.611`, and **B** to `0.203`.

26. Go to the **RGB** node and set the **Color** values for **R** to `0.900`, **G** to `0.123`, and **B** to `0.395`, as shown in the following screenshot:



Adding the color nodes

27. Save the file as `9931OS_organic.blend`.

How it works...

- From step 1 to 7, we built a shader that is very similar to the shaders that we have already seen for `SSS_materials`.
- From step 8 to 13, we built the bump pattern by using a single **Voronoi Texture** node tuned through three **ColorRamp** nodes with different settings.
- From step 14 to 16, we added, through the very low value of a **MixRGB** node, the values of a **Noise Texture** node to the vector of the **Voronoi Texture** node to obtain a less regular pattern.
- From step 17 to 25, we built the color pattern by establishing a base color by the **RGB** node and introducing a variation through the **MixRGB** nodes connected to the **Color** input sockets of the shader components. Note that the base pink color set in the **RGB** node goes straight to the SSS node. The **MixRGB** varied greenish color is multiplied by one of the bump outputs and then goes to the diffuse component of the shader, while the varied yellowish color is for the glossy component instead.

Creating a wasp-like chitin material with procedural textures

In this recipe, we will create a material similar to chitin (the characteristic substance of the exoskeletons of insects) colored with a yellow and black pattern like a wasp, as shown in the following screenshot:

The insect wasp-like material as it appears in the final rendering

Getting ready

Start Blender and open the `9931OS_08_start.blend` file, where there is an already set scene with an unwrapped **Suzanne** primitive object leaning on a Plane, an Emitter mesh-light, and a Camera.

Go to the **World** window and enable the **Ambient Occlusion** item with the **Factor** value `0.10`.

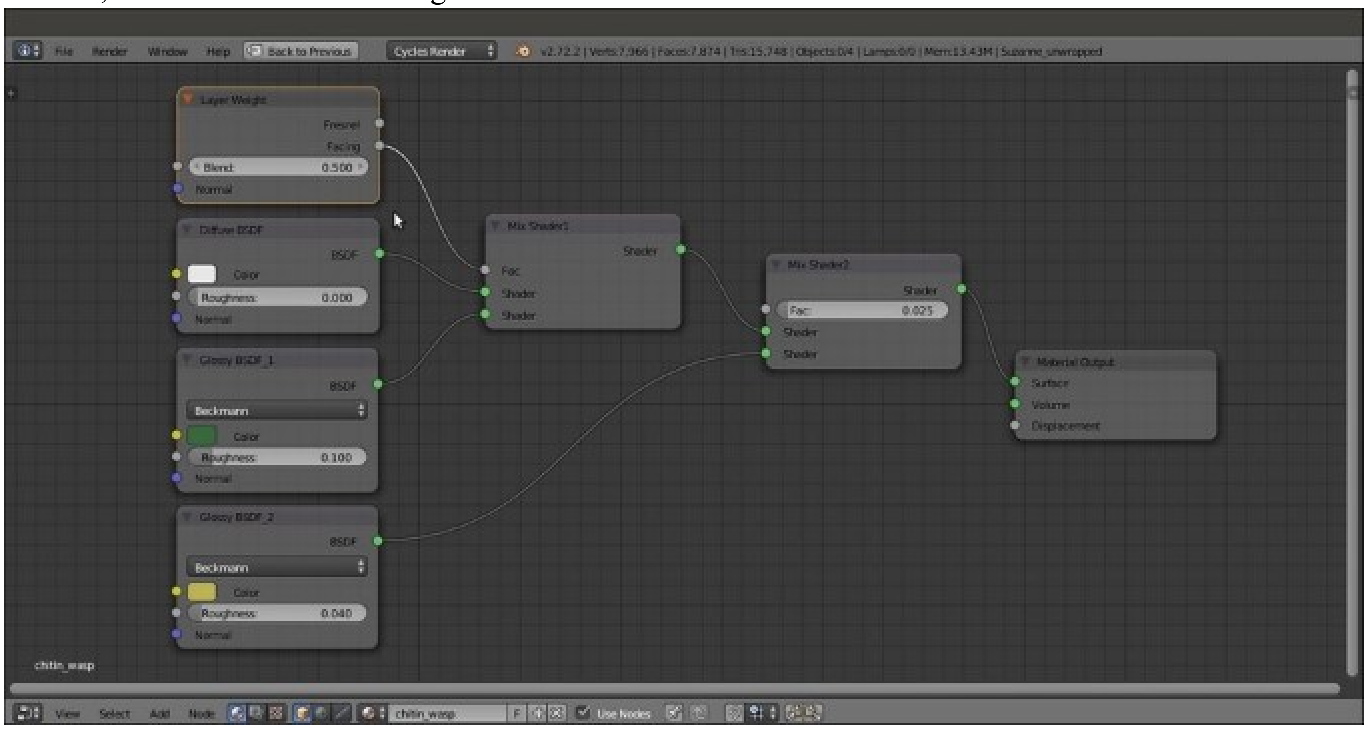
How to do it...

Let's start immediately with the material creation using the following steps:

1. Click on the **New** button in the **Node Editor** window toolbar or in the **Material** window under the main **Properties** panel to the right, and rename the new material `chitin_wasp`.
2. Now, in the **Material** window, switch the **Diffuse BSDF** shader with a **Mix Shader** node, and label it as `Mix Shader2`. In the first **Shader** slot, select a new **Mix Shader** node. In the second one, select a **Glossy BSDF** shader node. Label the new **Mix Shader** node as `Mix Shader1`, and the **Glossy BSDF** node as `Glossy BSDF_2`.
3. Go to the **Mix Shader1** node, and in the first **Shader** slot, select a **Diffuse BSDF** shader, and in the second one, select a new **Glossy BSDF** shader node. Label the latter as `Glossy BSDF_1`,

and set its **Roughness** value to `0.100` and **Distribution** to **Beckmann**, and change the **Color** value for **R** to `0.039`, **G** to `0.138`, and **B** to `0.046`.

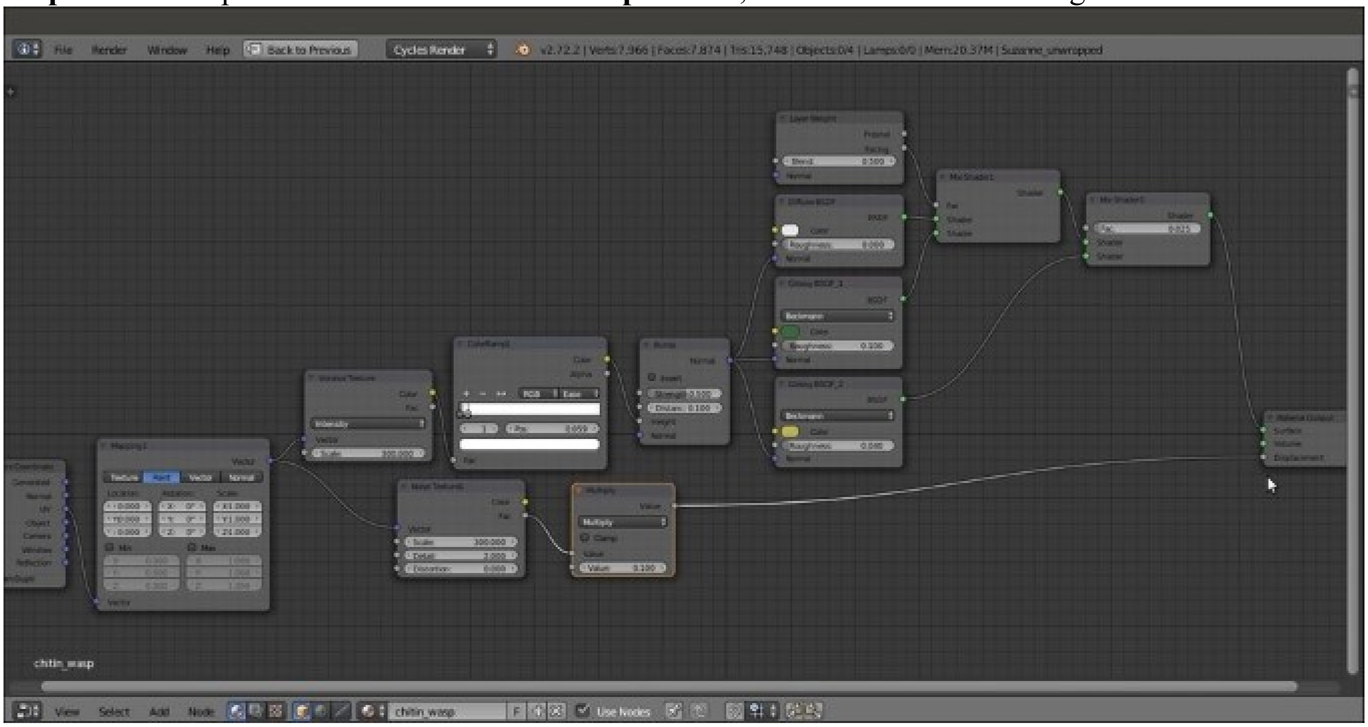
4. Set the **Glossy BSDF_2** node's **Roughness** value to `0.040` and **Distribution** to **Beckmann**, and change its **Color** values for **R** to `0.500`, **G** to `0.440`, and **B** to `0.086`. Set the **Fac** value of the **Mix Shader2** node to `0.025`.
5. Add a **Layer Weight** node (press *Shift* + *A* and navigate to **Input** | **Layer Weight**) and connect its **Facing** output to the **Fac** input socket of the **Mix Shader1** node. Leave the **Blend** value as `0.500`, as shown in the following screenshot:



The nodes for the base shader

6. Add a **Texture Coordinate** node (press *Shift* + *A* and navigate to **Input** | **Texture Coordinate**) and a **Mapping** node (press *Shift* + *A* and navigate to **Vector** | **Mapping**). Connect the **UV** output of the **Texture Coordinate** node to the **Vector** input of the **Mapping** node. Label the latter as `Mapping1`.
7. Add a **Voronoi Texture** node (press *Shift* + *A* and navigate to **Texture** | **Voronoi Texture**) and a **Noise Texture** node (press *Shift* + *A* and navigate to **Texture** | **Noise Texture**). Connect the **Mapping1** node's **Vector** output to their **Vector** input sockets. Set the **Scale** values of both the texture nodes to `300.000` and then label the **Noise Texture** node as `Noise Texture1`.
8. Add a **Bump** node (press *Shift* + *A* and navigate to **Vector** | **Bump**) and connect the **Color** output of the **Voronoi Texture** node to the **Height** input socket of the **Bump** node. Connect the **Normal** output of this node to the **Normal** input sockets of the **Diffuse BSDF** node and both **Glossy BSDF** shader nodes. Set the **Bump** node's **Strength** value to `0.500`.
9. Add a **ColorRamp** node (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**), label it as `ColorRamp1`, and paste it between the **Voronoi Texture** node and the **Bump** node. Set **Interpolation** to **Ease** and move the white color stop to the `0.059` position.

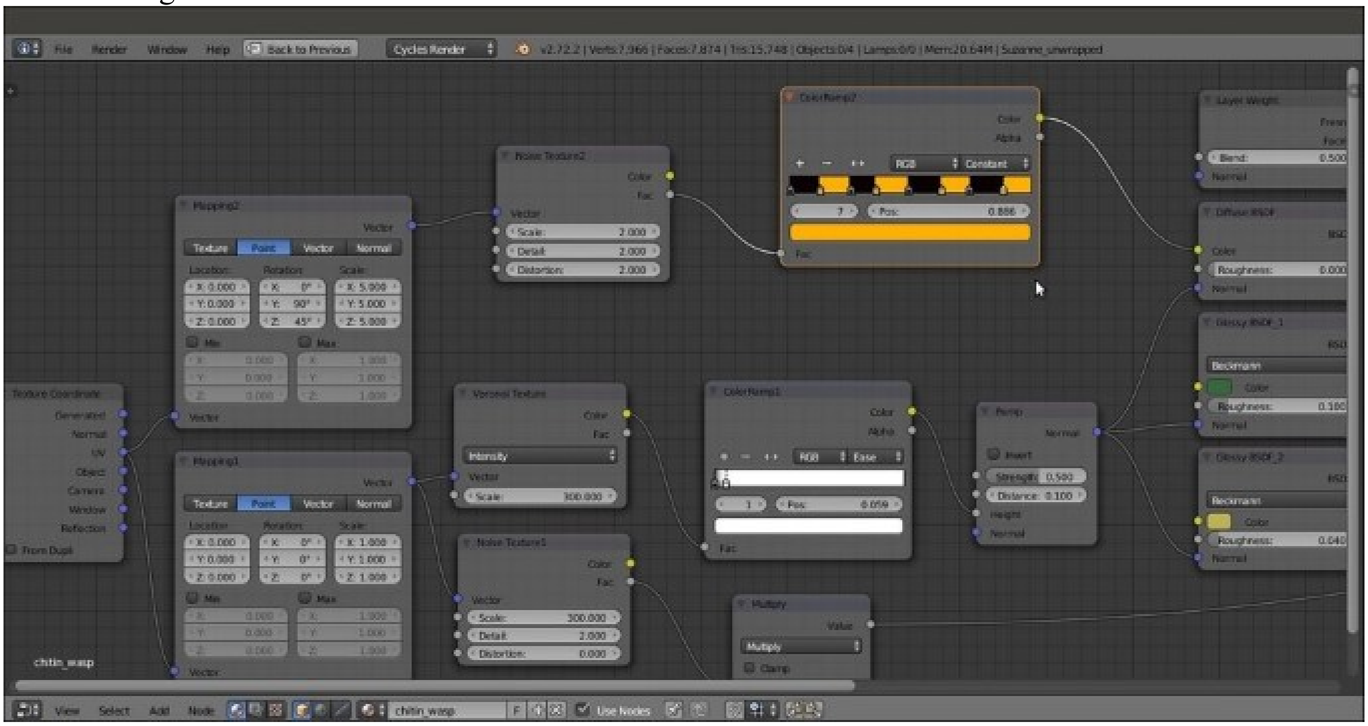
10. Add a **Math** node (press *Shift* + *A* and navigate to **Converter** | **Math**), set **Operation** to **Multiply**, and connect the **Fac** output of the **Noise Texture1** node to the first **Value** input socket of the **Math** node. Set the second **Value** to `0.100` and connect the **Value** output to the **Displacement** input socket of the **Material Output** node, as shown in the following screenshot:



Textures connected either as per the shader bump and the total bump to the Displacement input socket of the Material Output node

11. Add a new **Mapping** node (press *Shift* + *A* and navigate to **Vector** | **Mapping**), label it as `Mapping2`, and connect the **UV** output of the **Texture Coordinate** node to its **Vector** input socket. Set the **Rotation** value for **Y** to `90°` and the **Rotation** value of **Z** to `45°`. Set the **Scale** value for all three axes to `5.000`.
12. Add a **Noise Texture** node (press *Shift* + *A* and navigate to **Texture** | **Noise Texture**) and a **ColorRamp** node (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**). Label them as `Noise Texture2` and `ColorRamp2`.
13. Connect the output of the **Mapping2** node to the **Vector** input socket of the **Noise Texture2** node, and the **Fac** output of this node to the **Fac** input socket of **ColorRamp2**. Connect the output of this node to the **Color** input socket of the **Diffuse BSDF** shader node.
14. Go to the **Noise Texture2** node and set the **Scale** and **Distortion** values to `2.000`. Go to the **ColorRamp2** node and set **Interpolation** to **Constant**, select the white color stop, and change the **Color** values for **R** to `1.000`, **G** to `0.429`, and **B** to `0.000`.
15. Click on the **+** icon button to add new color stops until you have eight color stops almost evenly spaced along the slider (that is: color stop **0** at the `0.000` position, **1** at the `0.125` position, **2** at the `0.250` position, then `0.357`, `0.491`, `0.626`, `0.745`, and `0.886`).
16. Select the last color stop, put the mouse pointer on the color slider, and press *Ctrl* + *C* to copy the yellow color; then, select the color stops numbered **1**, **3**, and **5**, and paste the color (press

Ctrl + *V*) so as to have a slider subdivided in eight parts, four black and four yellow, as shown in the following screenshot:



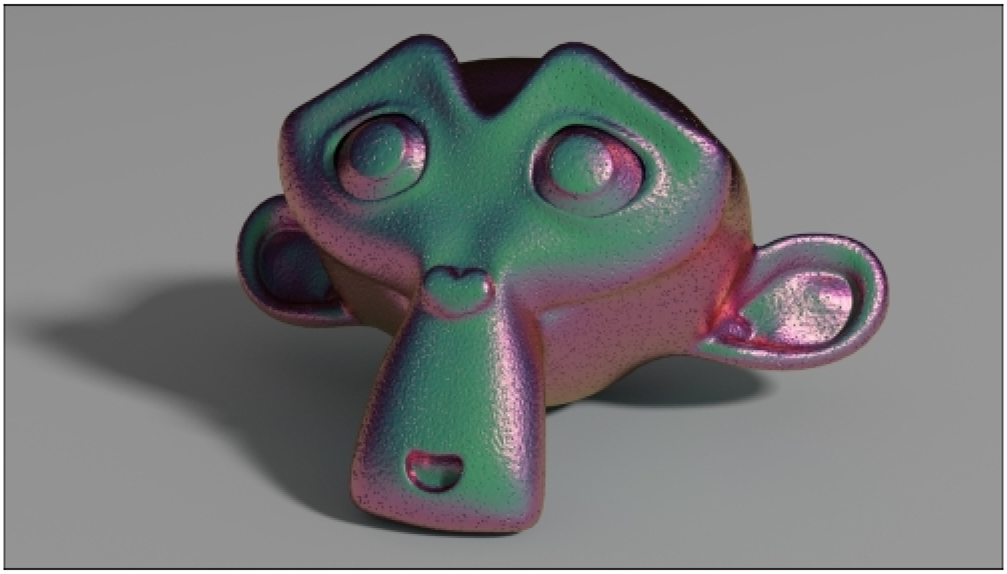
The color pattern connected to the diffuse component

How it works...

- From step 1 to 5, we built the basic shader using two **Glossy BSDF** shaders with different colors to mimic a color shifting in the specularity areas.
- From step 6 to 10, we built the chitin bump, assigning the pores to the per-shader bump but a general noise pattern to the displacement output (which, in this case, still works as a simple bump).
- From step 11 to 16, we built a simple and random wasp-colored pattern; obviously, this can be changed and modified as you prefer, and actually should also be used on a more appropriate model; in this case, it would be better to make use of a painted color texture map to build a more appropriate and symmetrical color pattern.

Creating a beetle-like chitin material with procedural textures

In this recipe, we will create a material similar to iridescent chitin (found in some kinds of beetles), as shown in the following screenshot:



The beetle chitin-like material as it appears in the final rendering

Getting ready

Start Blender and open the `9931OS_08_start.blend` file, where there is an already set scene with an unwrapped **Suzanne** primitive object leaning on a Plane, an Emitter mesh-light, and a Camera.

Go to the **World** window and enable the **Ambient Occlusion** option with the **Factor** value as `0.10`.

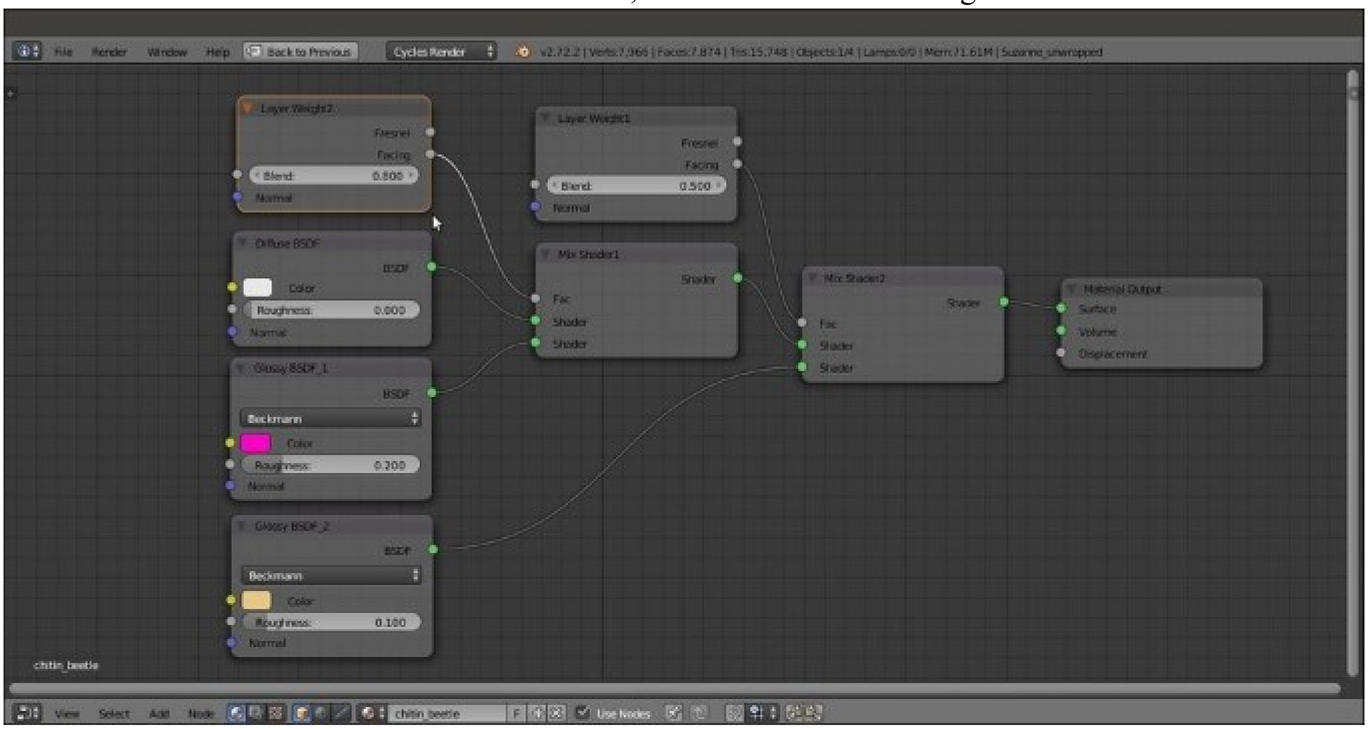
How to do it...

Let's start immediately with the material creation using the following steps:

1. Click on the **New** button in the **Node Editor** window's toolbar or in the **Material** window under the main **Properties** panel to the right, and rename the new material as `chitin_beetle`.
2. Now, in the **Material** window, switch the **Diffuse BSDF** shader with a **Mix Shader** node and label it as `Mix Shader2`. In the first **Shader** slot, select a new **Mix Shader** node; in the second **Mix Shader** node, select a **Glossy BSDF** shader node. Label the new **Mix Shader** node as `Mix Shader1`, and the **Glossy BSDF** one as `Glossy BSDF_2`.
3. Go to the **Mix Shader1** node, and in the first **Shader** slot, select a **Diffuse BSDF** shader, and in the second one, select a new **Glossy BSDF** shader node; label this node as `Glossy BSDF_1`

and set its **Roughness** value to `0.200` and **Distribution** to **Beckmann**, and change the **Color** values for **R** to `1.000`, **G** to `0.000`, and **B** to `0.562`.

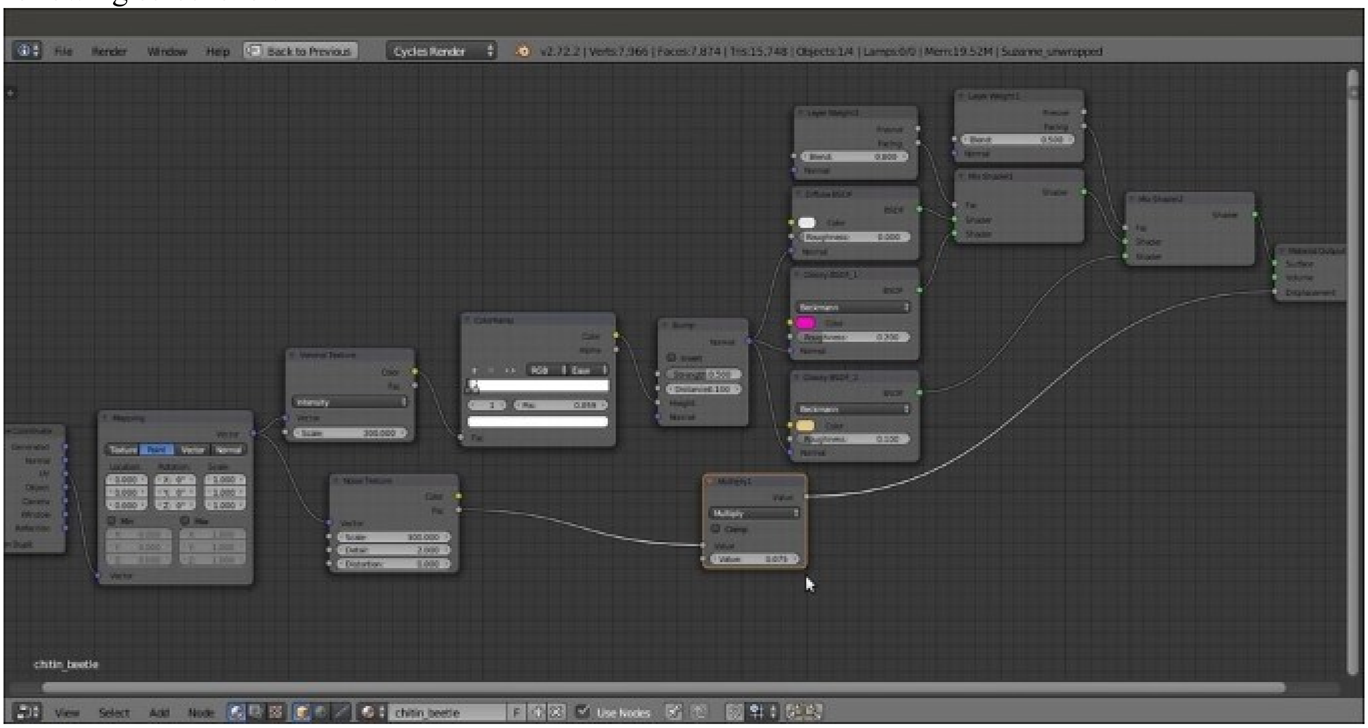
4. Set the **Glossy BSDF_2** node's **Roughness** value to `0.100` and **Distribution** to **Beckmann**, and change its **Color** values for **R** to `0.800`, **G** to `0.574`, and **B** to `0.233`.
5. Add a **Layer Weight** node (press *Shift* + *A* and navigate to **Input** | **Layer Weight**), label it as `Layer Weight1`, and connect its **Facing** output to the **Fac** input socket of the **Mix Shader2** node. Leave the **Blend** value at `0.500`.
6. Add a second **Layer Weight** node (press *Shift* + *A* and navigate to **Input** | **Layer Weight**), label it as `Layer Weight2`, and connect its **Facing** output to the **Fac** input socket of the **Mix Shader1** node. Leave the **Blend** value at `0.800`, as shown in the following screenshot:



The shader part of the material

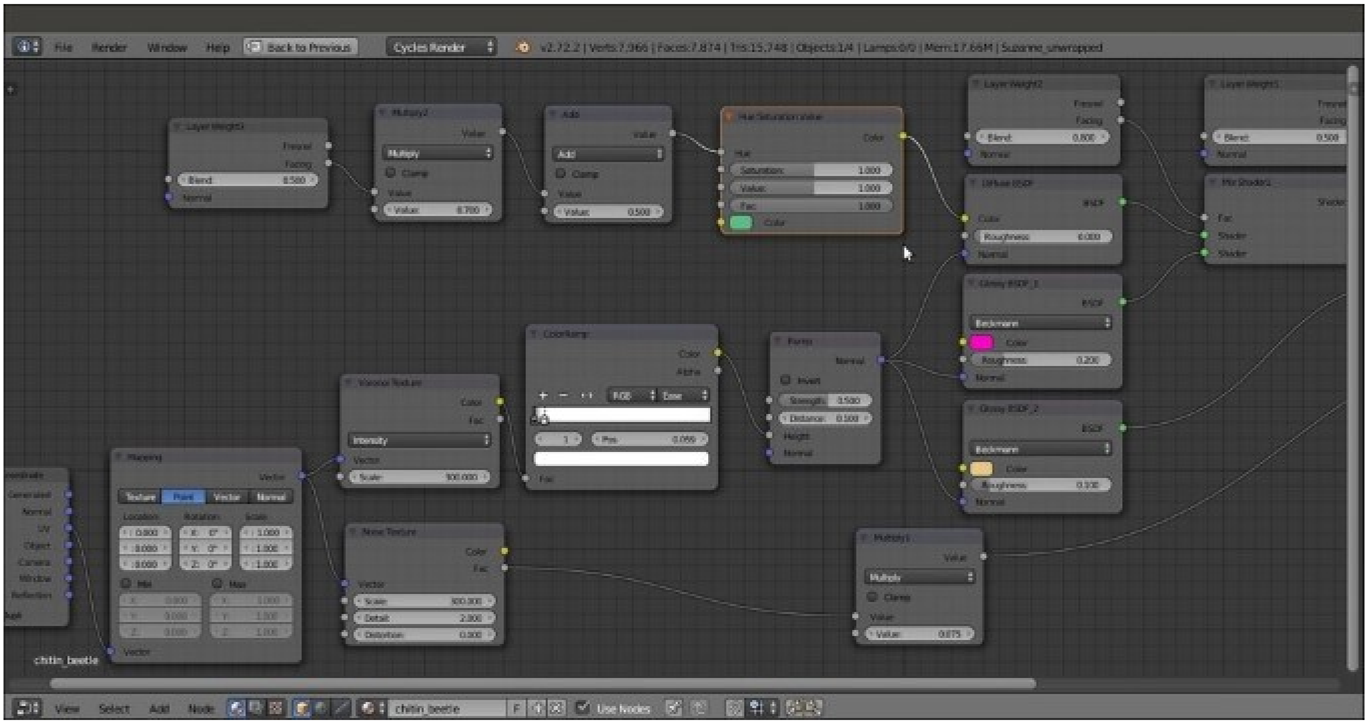
7. Add a **Texture Coordinate** node (press *Shift* + *A* and navigate to **Input** | **Texture Coordinate**) and a **Mapping** node (press *Shift* + *A* and navigate to **Vector** | **Mapping**). Connect the **UV** output of the **Texture Coordinate** node to the **Vector** input of the **Mapping** node.
8. Add a **Voronoi Texture** node (press *Shift* + *A* and navigate to **Texture** | **Voronoi Texture**) and a **Noise Texture** node (press *Shift* + *A* and navigate to **Texture** | **Noise Texture**); connect the **Mapping** output to their **Vector** input sockets. Set the **Scale** values of both the texture nodes to `300.000`.
9. Add a **Bump** node (press *Shift* + *A* and navigate to **Vector** | **Bump**) and connect the **Color** output of the **Voronoi Texture** node to the **Height** input socket of the **Bump** node; connect the **Normal** output of this node to the **Normal** input sockets of **Diffuse BSDF** and of both the **Glossy BSDF** shader nodes. Set the **Bump** node's **Strength** value to `0.500`.

10. Add a **ColorRamp** node (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**) and paste it between the **Voronoi Texture** node and the **Bump** node. Set **Interpolation** to **Ease** and move the white color stop to the `0.059` position.
11. Add a **Math** node (press *Shift* + *A* and navigate to **Converter** | **Math**), set **Operation** to **Multiply**, and label it as `Multiply1`; connect the **Fac** output of the **Noise Texture** node to the first **Value** input socket of the **Math** node. Set the second **Value** to `0.075` and connect the **Value** output to the **Displacement** input socket of the **Material Output** node, as shown in the following screenshot:



The bump is both "per shader" and as "total" bump (as in the previous wasp material recipe)

12. Add a new **Layer Weight** node (press *Shift* + *A* and navigate to **Input** | **Layer Weight**), two **Math** nodes (press *Shift* + *A* and navigate to **Converter** | **Math**), and a **Hue Saturation Value** node (press *Shift* + *A* and navigate to **Color** | **Hue/Saturation**); label the new **Layer Weight** node as `Layer Weight3`.
13. Connect the **Facing** output of the **Layer Weight3** node to the first **Value** input socket of one of the **Math** nodes; set its **Operation** to **Multiply** and the second **Value** to `0.700`, and label it as `Multiply2`.
14. Connect the **Multiply2** node's output to the first **Value** input socket of the second **Math** node, and the output of this node to the **Hue** input socket of the **Hue Saturation Value** node; connect the output of this node to the **Color** input socket of the **Diffuse BSDF** shader node.
15. Change the **Hue Saturation Value** node's **Color** values for **R** to `0.103`, **G** to `0.500`, and **B** to `0.229`, and just for this example, leave the other values as they are, as shown in the following screenshot:



Adding the final diffuse color

How it works...

- The introductory steps of this shader work almost the same as for the `chitin_wasp` material, that is, the basic shader from step 1 to 6 and the chitin bump from step 7 to 11.
- From step 12 to 15, we build the color component coming from the **Hue Saturation Value** node, and thanks to the combination of the **Layer Weight3** and **Math** nodes, this appears mainly in the mesh faces perpendicular to the point of view, sliding in the other spectrum colors on the facing-away mesh sides, basically behaving as a sort of Fresnel effect. The addition of the **Hue Saturation Value** node allows for further color tweaking.

Creating tree shaders – the bark

There are several different ways to make trees in a 3D package: starting from the simpler low-poly objects, such as the billboards used in video games (simple planes mapped with tree images on a transparent background), to middle complex objects where a trunk mesh is attached to a foliage mass made of little alpha textured planes, each one representing a leaf or even a twig, to more complex and heavy meshes, where every little branch and leaf is actually modeled.

In case you need them, you can find several free tree models in the Blender format and also their billboard versions at http://yorik.uncreated.net/greenhouse.html.

For this two-part tree shader recipe, we will instead use a model coming from the many environment assets of the CG short *Big Buck Bunny*, the second open movie produced by the Blender Foundation. All the movie assets are free to be downloaded, distributed, and reused even for commercial projects because the short is licensed under the Creative Commons Attribution 3.0 license (refer to its official website at http://creativecommons.org/licenses/by/3.0/).

The general shape of the tree and the leaves is pretty toyish. This is because they are elements that have been drawn to match the toon style of the furry characters, but it's actually perfectly suited for our demonstration purposes. The final rendered tree from *Big Buck Bunny* is shown in the following screenshot for your reference:

The final rendered tree from Big Buck Bunny

The tree model is composed of several parts: on the first layer, there are the **tree_trunk**, the **tree_branch**, and the **tree_branches** meshes, and on the second layer are the leaves, made by a single leaf object dupliverted on the tiny faces of the **leaves_dupli** object. (That is, the **leaf_tobeswitched** object is parented to the **leaves_dupli** object, and then, in the **Object** window and under the **Duplication** subpanel, the **Faces** duplication method has been selected, the **Scale** item checked, and the **Inherit Scale** value set to `1110.000`. This way, the **leaf_tobeswitched** object is instanced on the **leaves_dupli** object's many faces according to their location, rotation, and scale.)

On the 11th layer, there are three leaf objects with three different levels of detail: a simple flat Plane, a subdivided and curved Plane, and a modeled leaf. Their presence is only to supply the low, middle, and high resolution mesh data. By selecting the **leaf_tobeswitched** object and by going to the **Object data** window, it is possible to switch between the **leaf_generic_low**, **leaf_generic_mid**, and **leaf_generic_hi** foliage levels of detail.

In the first part of this two-part recipe, we will create the material for the bark, as shown in the following screenshot:

The bark material

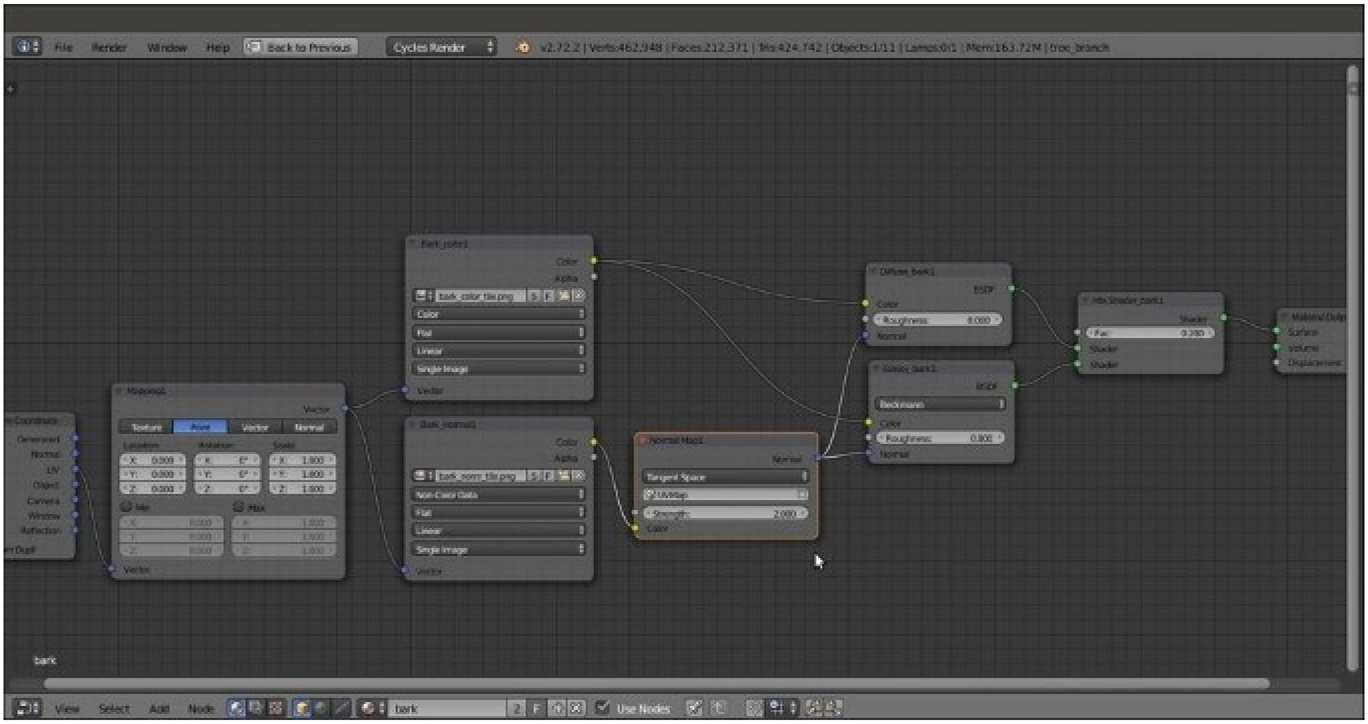
Getting ready

Start Blender and open the `9931OS_08_tree_start.blend` file. For this recipe, deactivate the second layer, and in **Outliner**, select the **tree_trunk** object.

How to do it...

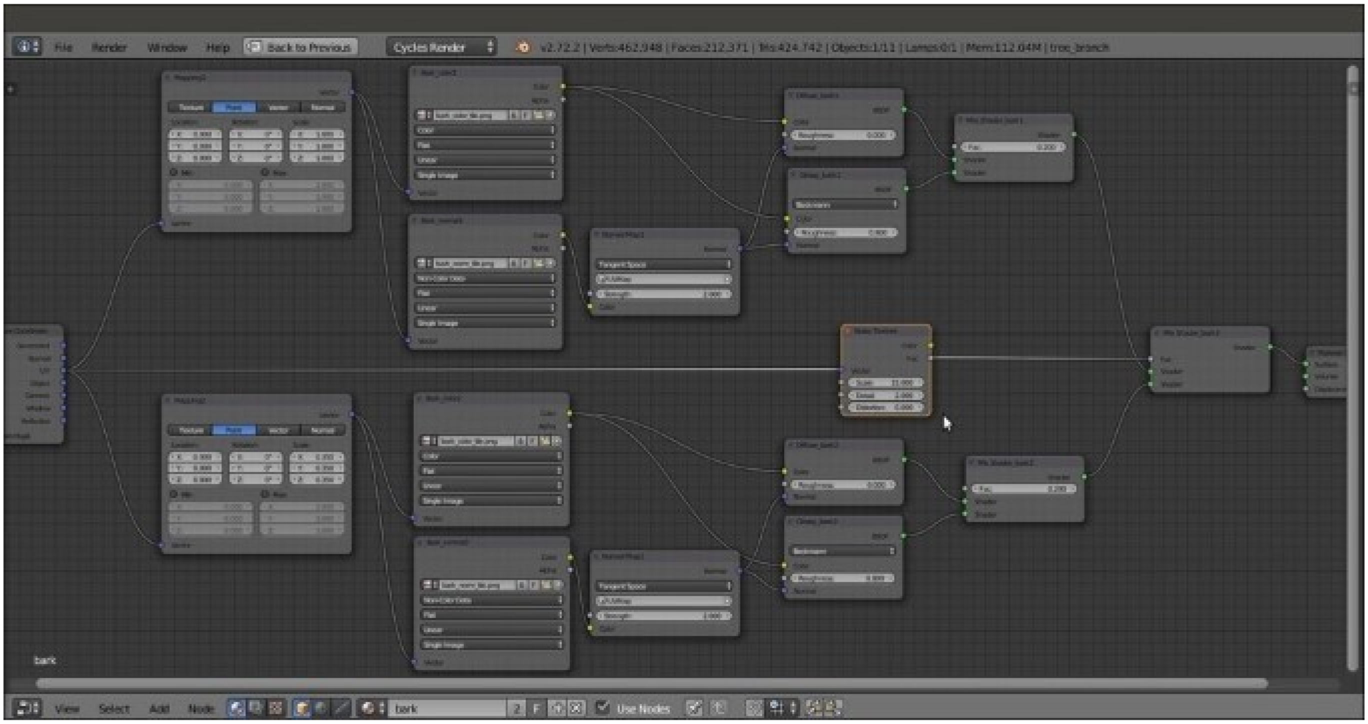
Let's start by creating the bark material using the following steps:

1. Click on the **New** button in the **Node Editor** window toolbar or in the **Material** window, and rename the material as `bark`.
2. Still in the **Material** window, switch the **Diffuse BSDF** shader with a **Mix Shader** node, and label it as `Mix Shader_bark1`. In the first **Shader** slot, select a **Diffuse BSDF** shader node, and in the second one, select a **Glossy BSDF** shader node; then, label them as `Diffuse_bark1` and `Glossy_bark1`. Set the **Glossy_bark** distribution to **Beckmann**, the **Roughness** value to `0.800`, and the **Mix Shader_bark1** node's **Fac** value to `0.200`.
3. Add a **Texture Coordinate** node (press *Shift* + *A* and navigate to **Input** | **Texture Coordinate**), a **Mapping** node (press *Shift* + *A* and navigate to **Vector** | **Mapping**), and an **Image Texture** node (press *Shift* + *A* and navigate to **Texture** | **Image Texture**); label the last two as `Mapping1` and `Bark_color1`.
4. Connect the **UV** output of the **Texture Coordinate** node to the **Vector** input socket of the **Mapping1** node, and the output of this node to the **Vector** input socket of the **Bark_color1** node. Connect the **Color** output of the **Bark_color1** node to the **Color** input sockets of both the **Diffuse_bark1** and **Glossy_bark1** shader nodes.
5. Click on the **Open** button of the **Bark_color1** node, browse to the `textures` folder, and load the `bark_color_tile.png` image.
6. Press *Shift* + *D* to duplicate the **Bark_color1** node, label it as `Bark_normal1`, and connect the **Mapping1** node output to its **Vector** input socket. Make the image datablock single-user by clicking on **2**, which appears on the right side of the image name. Click on the **Open Image** button (the one with the folder icon), browse again to the `textures` folder, and load the `bark_norm_tile.png` image. Set **Color Space** to **Non-Color Data**.
7. Add a **Normal Map** node (press *Shift* + *A* and navigate to **Vector** | **Normal Map**), label it as `Normal Map1`, and connect the **Color** output of the **Bark_normal1** node to the **Color** input socket of the **Normal Map1** node, and then set the **Strength** value to `2.000`. Click on the **UV Map for tangent space maps** button upwards of the **Strength** one and select **UVMap** (the trunk mesh has two different sets of UV coordinates, which we'll see later).
8. Connect the **Normal** output of the **Normal Map1** node to the **Normal** input sockets of both the **Diffuse_bark1** and the **Glossy_bark1 shader** nodes, as shown in the following screenshot:



The basic bark material that uses a normal map

9. Now, box-select (press the *B* key and then draw a rectangle) all the nodes except for the **Texture Coordinate** and **Material Output** nodes and press *Shift* + *D* duplicate them. Move them down and change their labels by substituting the 1 suffix with 2. Connect the **UV** output of the **Texture Coordinate** node to the **Vector** input socket of the duplicated **Mapping2** node, and set the **Scale** of this node to `0.350` for all three axes.
10. Add a **Mix Shader** node (press *Shift* + *A* and navigate to **Shader** | **Mix Shader**), label it as `Mix Shader_bark3`, and paste it right before the **Material Output** node. Connect the output of the **Mix Shader_bark2** node to the second **Shader** input socket of the **Mix Shader_bark3** node.
11. Add a **Noise Texture** node (press *Shift* + *A* and navigate to **Texture** | **Noise Texture**), connect the **UV** output of the **Texture Coordinate** node to the **Vector** input socket of the **Noise Texture** node, and connect the **Fac** output of this node to the **Fac** input socket of the **Mix Shader_bark3** node.
12. Set the **Noise Texture** node's **Scale** value to `15.000`, as shown in the following screenshot:



Making the bark material a bit more complex

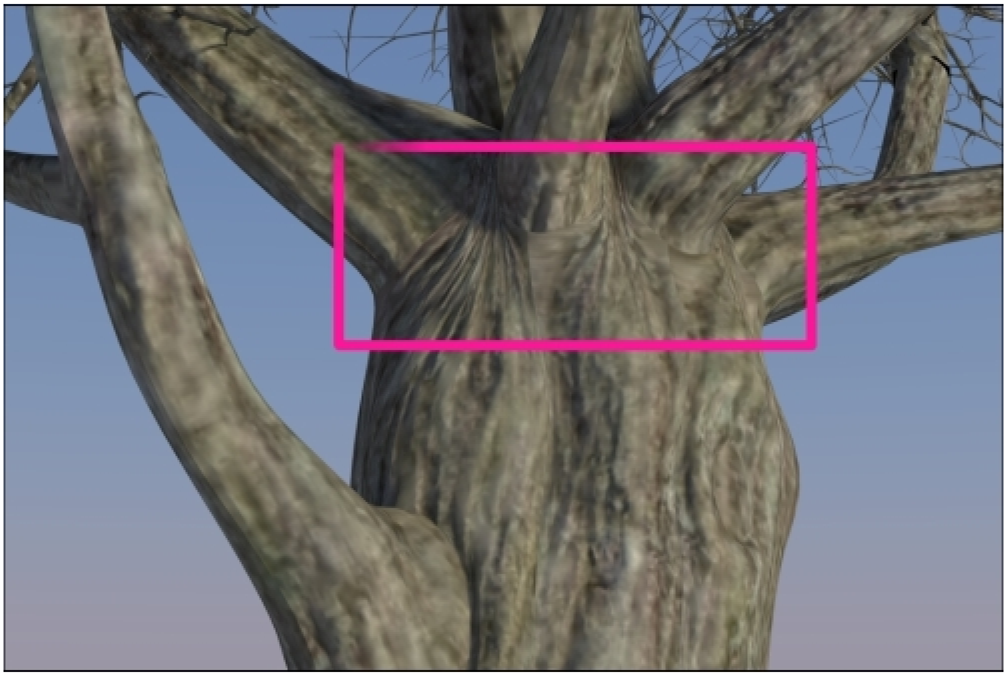
13. Now, press *Shift* and select the **tree_branch** and **tree_branches** meshes, and as the last one, reselect the **tree_trunk** mesh to make it the active object; then, press *Ctrl* + *L*. In the **Make Links** pop-up menu, select the **Materials** item to assign the bark material to the other two meshes.

How it works...

- For this material, we built a simple shader using two tileable image maps, a color one for the Diffuse and the Glossy components, and a normal map for the bump.
- Then, we duplicated everything and mixed the second material copy with different scale values to the first one by the factor of a Noise procedural texture, to add variety to the bark pattern and to avoid that unpleasant repeating effect that often shows up with tileable image textures.

There's more...

At this point, if you look carefully at the **Rendered** view of the tree trunk, you'll see that sadly, there are ugly seams where the trunk's main body joins the big low branches as shown in the following screenshot:

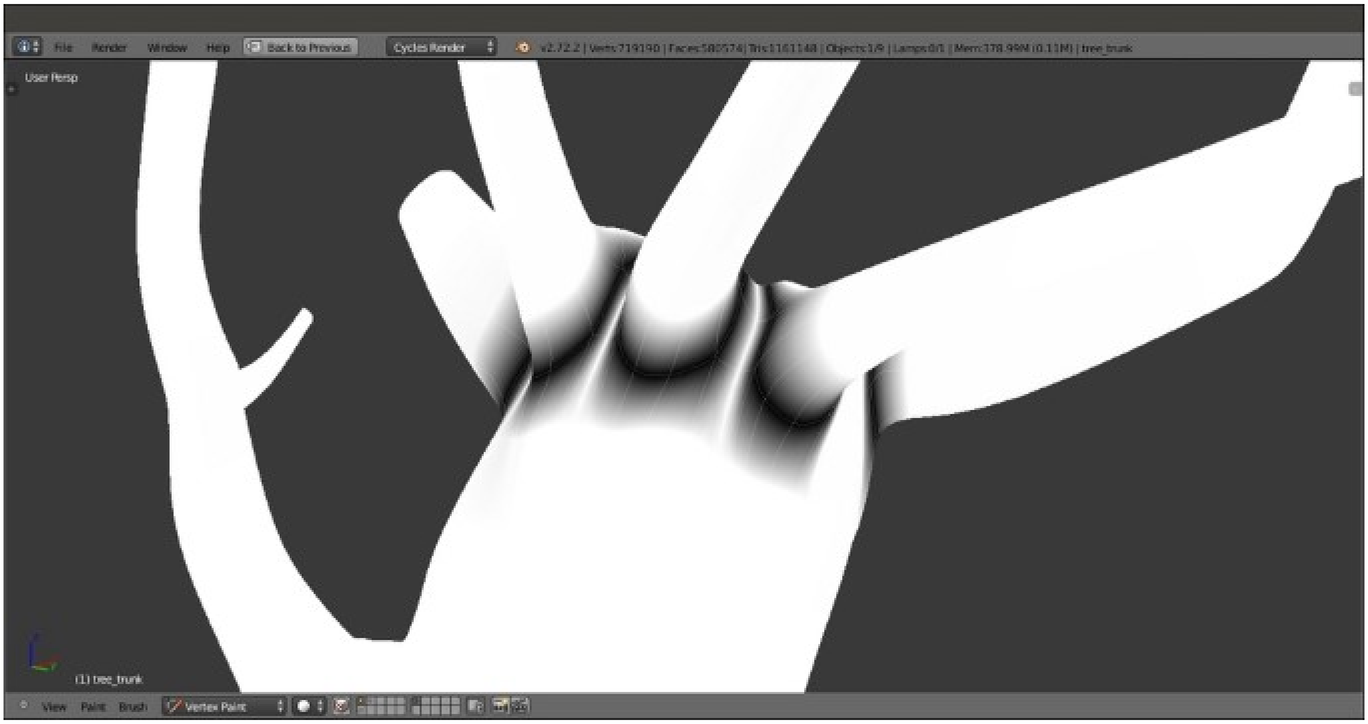


The visible seams at the branches joining

This is due to the fact that the unwrap of the mesh has separated the branches' UV islands from the main trunk ones. Although the effect can be barely visible, let's say that you absolutely want to avoid this; that's why we are now going to see a solution for the problem, by using a second set of UV coordinates and a Vertex Color layer.

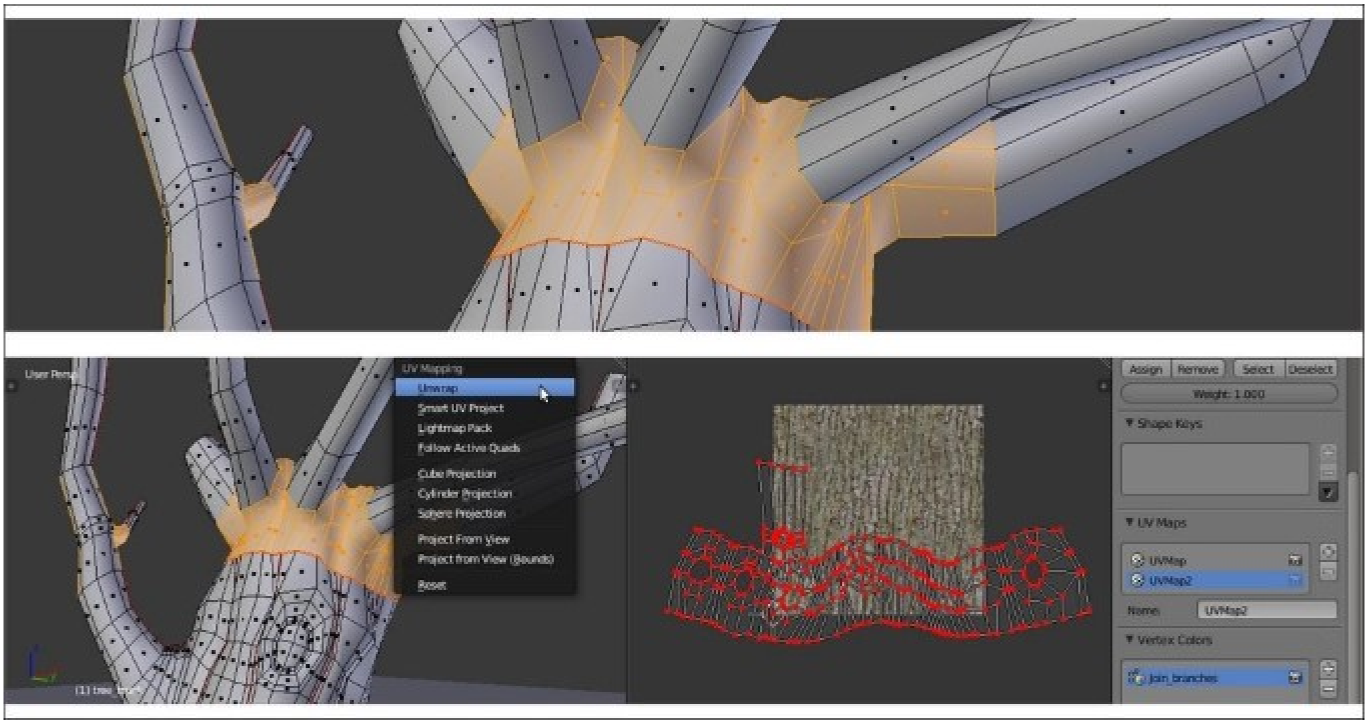
This is what we are going to do:

1. Select the **trunk** mesh and go into the **Vertex Paint** mode; the mesh turns totally white, because that is the color assigned to the vertexes by default. Start to paint with pure black on the vertexes located at the joining of the low branches with the trunk, achieving this result:



The trunk model seen in the Vertex Paint mode

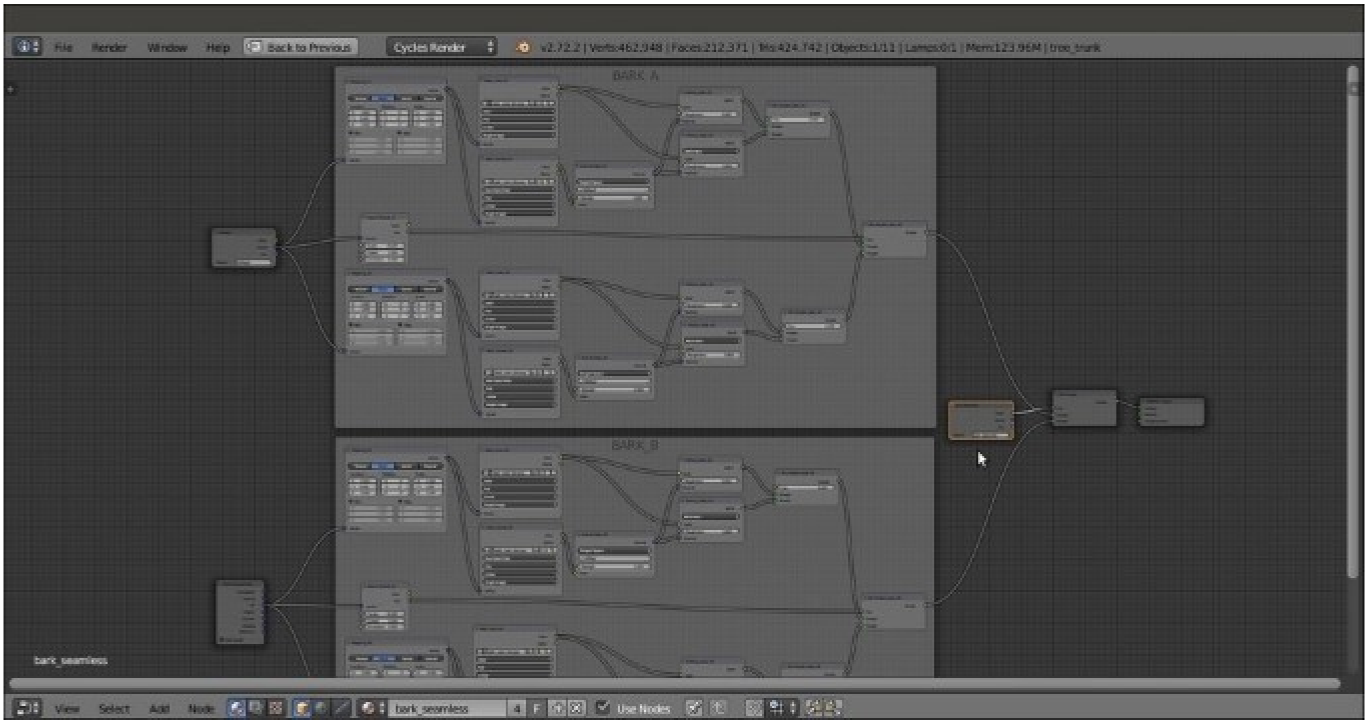
2. As you can see, the joining vertices edge loops are black but are smoothly blending into the white of the default mesh vertex color. This will be used as a stencil map to blend two different instances of the same bark material mapped on different UV coordinates. Go to the **Object data** window and rename the **Vertex Color** layer as `Join_branches`.
3. Switch to **Edit Mode** and select all the faces including the necessary vertices' edge loops; in the **Object data** window, under the **UV Maps** subpanel, click on the **+** icon (add **UV Map**) and rename the new UV coordinates layer as `UVMap2`. Place the mouse cursor on the 3D viewport, press **U**, and select **Unwrap** in the **UV Mapping** pop-up menu, as shown in the following screenshot:



The trunk model in Edit Mode and the UV islands in the UV/Image Editor window

4. Go out of **Edit Mode**. Click on the user number to the right of the material data block in the **Node Editor** window toolbar and rename the new material as `bark_seamless`.

   Now, by looking at the following screenshot, it is clear what we have to do:



Two identical bark materials mapped on different UV layers and mixed on the ground of the Vertex Paint output

5. Make a duplicate of the bark material and blend the two shaders (inside the **BARK_A** and **BARK_B** frames respectively) using a **Mix Shader** node, modulated by the **Join_branches** vertex color stencil. Use an **Attribute** node both for the **Vertex Color** layer output and to set the **UVMap2** coordinates layer for the copy of the bark material. Now, the output looks similar to what is shown in the following screenshot:

The final result: no more seams

As you can see in the preceding screenshot, there are no more visible seams; the two differently UV mapped materials smoothly blend together.

Creating tree shaders – the leaves

In this second tree recipe, we will create the leaves shaders, as shown in the following screenshot:

The leaves as they appear in the final rendering

Getting ready

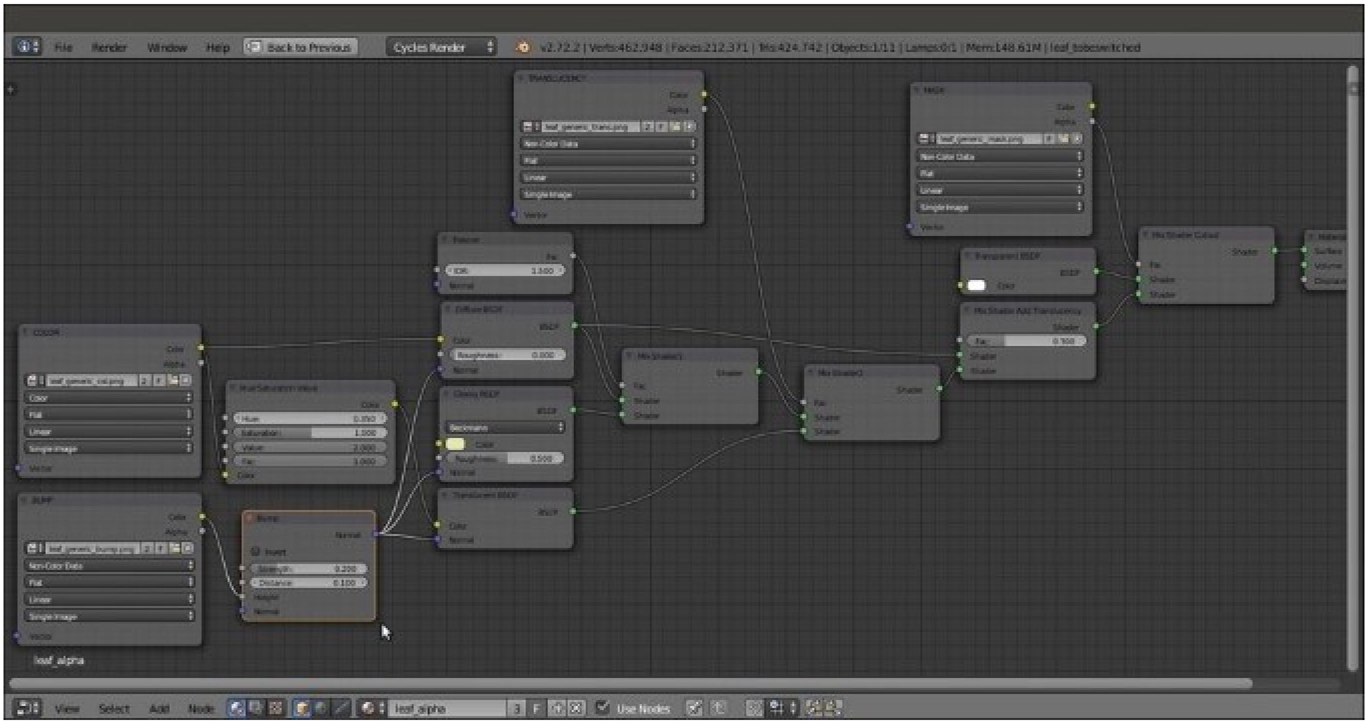
Carrying on with the blend file of the previous recipe, now, activate (hold *Shift* while clicking) the 2nd and the 11th scene layers, and in **Outliner**, select the **leaf_generic_mid** object.

How to do it...

Let's proceed with the creation of the leaves shaders:

1. Click on the **New** button in the **Node Editor** window toolbar or in the **Material** window, and rename the material as `leaf_alpha`.
2. In the **Material** window, switch the **Diffuse BSDF** shader with a **Mix Shader** node and label it as **Mix Shader Cutout**; in the first **Shader** slot, select a **Transparent BSDF** shader node, and in the second one, select a new **Mix Shader** node, which will be labeled as **Mix Shader Add Translucency**.
3. Add an **Image Texture** node (press *Shift* + *A* and navigate to **Texture | Image Texture**), label it as `MASK`, and connect its **Alpha** output to the **Fac** input socket of the **Mix Shader Cutout** node.

4. Click on the **Open** button of the **MASK** node, browse to the `textures` folder, and load the `leaf_generic_mask.png` image (which actually is a simple black leaf silhouette with a transparent alpha channel). Set **Color Space** to **Non-Color Data**.
5. Add a **Diffuse BSDF** node (press *Shift* + *A* and navigate to **Shader** | **Diffuse BSDF**), a **Glossy BSDF** node (press *Shift* + *A* and navigate to **Shader** | **Glossy BSDF**), and a **Translucent BSDF** node (press *Shift* + *A* and navigate to **Shader** | **Translucent BSDF**).
6. Add two new **Mix Shader** nodes (press *Shift* + *A* and navigate to **Shader** | **Mix Shader**), and label them as `Mix Shader1` and `Mix Shader2`.
7. Connect the output of the **Diffuse BSDF** shader to the first **Shader** input socket of the **Mix Shader1** node, and the output of the **Glossy BSDF** shader to the second **Shader** input socket. Set the **Glossy BSDF** node's **Distribution** to **Beckmann**, and change the **Color** values for **R** to `0.794`, **G** to `0.800`, and **B** to `0.413`, and the **Roughness** value to `0.500`.
8. Connect the output of the **Mix Shader1** node to the first **Shader** input socket of the **Mix Shader2** node, and the output of the **Translucent** node to the second one; connect the output of the **Mix Shader2** node to the second **Shader** input socket of the **Mix Shader Add Translucency** node.
9. Connect the output of the **Diffuse BSDF** shader node to the first **Shader** input socket of the **Mix Shader Add Translucency** node. Set its **Fac** value to `0.300` (this value establishes the amount of translucency in the shader).
10. Add an **Image Texture** node (press *Shift* + *A* and navigate to **Texture** | **Image Texture**), label it as `TRANSLUCENCY`, and connect its **Color** output to the **Fac** input socket of the **Mix Shader2** node. Click on the **Open** button, browse to the usual `textures` folder, and load the `leaf_generic_trans.png` image. Set **Color Space** to **Non-Color Data**.
11. Add a **Fresnel** node (press *Shift* + *A* and navigate to **Input** | **Fresnel**), connect it to the **Fac** input socket of the **Mix Shader1** node, and set **IOR** to `1.500`.
12. Add an **Image Texture** node (press *Shift* + *A* and navigate to **Texture** | **Image Texture**), label it as `COLOR`, and connect its **Color** output to the **Color** input socket of the **Diffuse BSDF** shader node and to the **Color** input socket of the **Translucent BSDF** node. Click on the **Open** button, browse to the `textures` folder, and load the `leaf_generic_col.png` image.
13. Add a **Hue Saturation Value** node (press *Shift* + *A* and navigate to **Color** | **Hue/Saturation**) and paste it between the **COLOR** image texture node and the **Translucent BSDF** shader node. Set the **Hue** value to `0.350` and **Value** to `2.000`.
14. Add a last **Image Texture** node (press *Shift* + *A* and navigate to **Texture** | **Image Texture**) and label it as `BUMP`; add a **Bump** node (press *Shift* + *A* and navigate to **Vector** | **Bump**) and connect the **BUMP** image node's **Color** output to the **Height** input socket of the **Bump** node, and the **Normal** output socket of this node to the **Normal** input sockets of the **Diffuse BSDF**, **Glossy BSDF**, and **Translucent BSDF** shader nodes.
15. Click on the **Open** button, browse to the `textures` folder, and load the `leaf_generic_bump.png` image. Set **Color Space** to **Non-Color Data** and the **Bump** node's **Strength** value to `0.200`, as shown in the following screenshot:



The leaf_alpha material network

How it works...

- From step 1 to 11, we built the basic shader of the leaf, using an image that has alpha channel data to cut out the leaf shape on the Plane and a gray-scale image to drive the translucency effect.
- From step 12 to 15, we added the color of the leaf, using it also with a hue and intensity variation for the translucency color, and then we added the bump.

There's more...

Now, assign the same material to both the `leaf_generic_low` and `leaf_generic_hi` meshes on the 11th layer.

The modeled leaf mesh doesn't need the alpha channel, so select the **leaf_generic_hi** object, and in the toolbar of the **Node Editor** window, click on **user data number** to make it **single-user**. Rename the new material as `leaf` and delete the **MASK** and **Transparent BSDF** nodes, and then press *Alt* + *D* to remove the **Mix Shader Cutout** node from the link and delete it as well.

Remember that the examples in the preceding and following images are made with very stylized models that come from the *Big Buck Bunny* short movie; real objects have more subtle details and more random repeating patterns, but in this case, this just depends on the image textures you are going to use for your material.

Such a shader is of good use not only for leaves, but also for other kinds of plants; in many cases, it's enough to give variations to the color.

Creating a layered human skin material in Cycles

In this recipe, we will create a layered skin material by using the open-content character Sintel.

Sintel is the main character of the third open movie of the same name produced by the Blender Foundation; the Sintel character and all the other movie assets are licensed under the Creative Commons Attribution 3.0 license (http://creativecommons.org/licenses/by/3.0/). The following screenshot is of Sintel's face:

Sintel's face in the final rendering

Getting ready

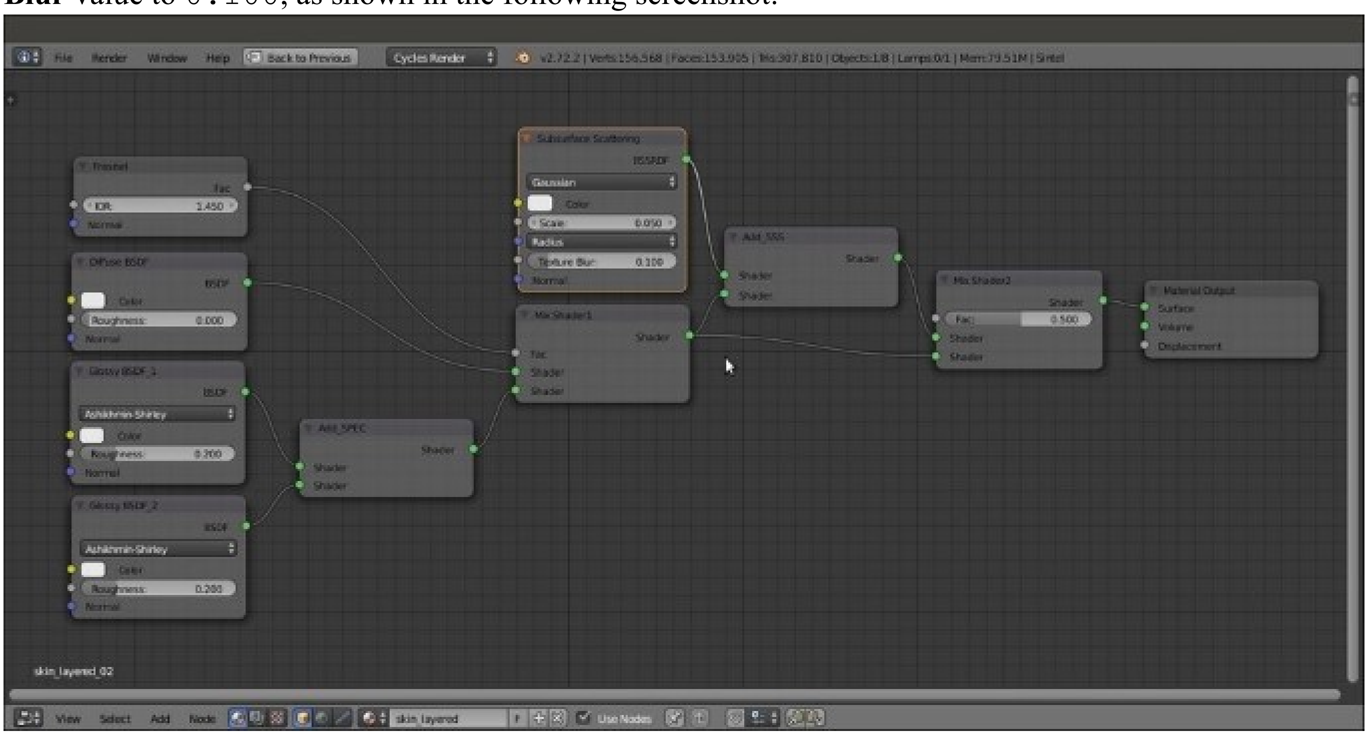
Start Blender and open the `9931OS_08_skin_start.blend` file, where there is an already set scene with the Sintel character standing on a Plane, a Sun lamp, and a Camera.

Except for Sintel's body skin, all the other mesh objects have either gesso-like materials or eyes already assigned.

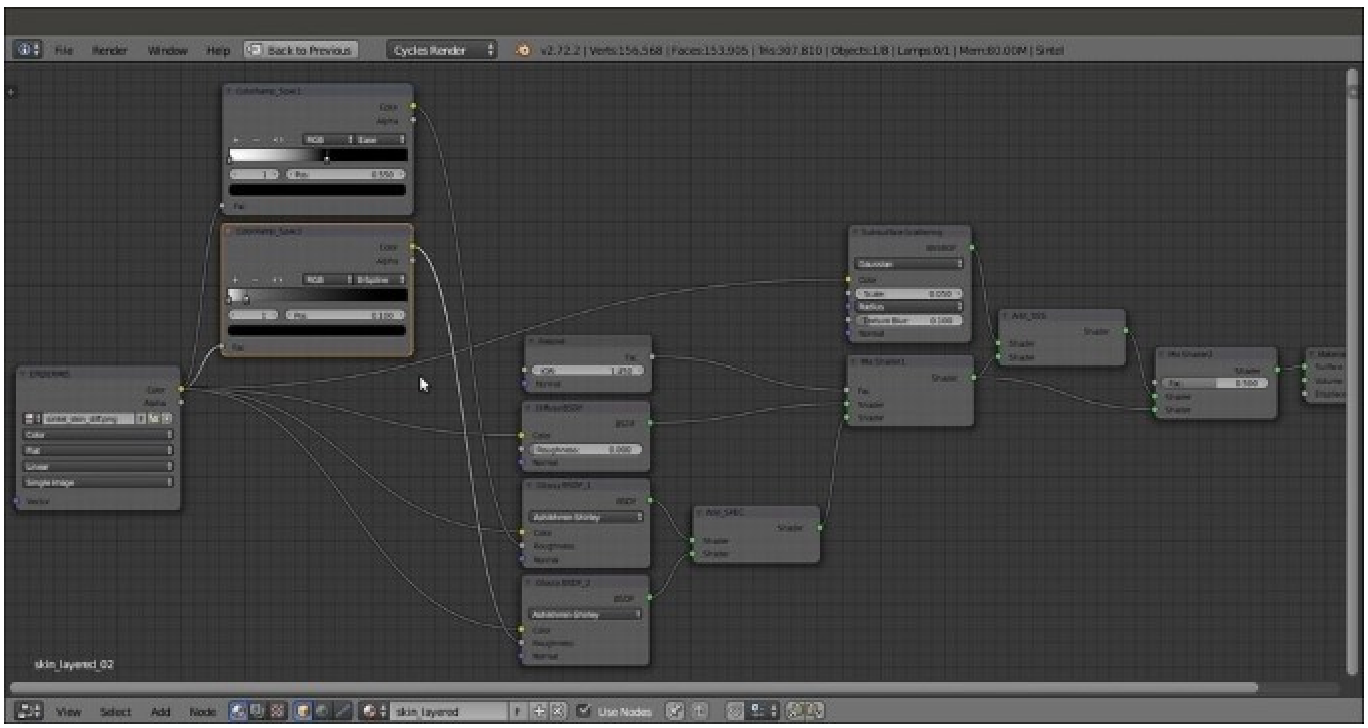
How to do it...

Let's start with the layered skin shader creation:

1. Be sure to have the **Sintel** object selected, and then click on the **New** button in the **Node Editor** window toolbar or in the **Material** window under the main **Properties** panel and rename the material as `skin_layered`.
2. In the **Material** window, switch the **Diffuse BSDF** shader with a **Mix Shader** node; go to the **Active Node** panel to the right of the **Node Editor** window (if not present, put the mouse in the **Node Editor** window and press *N* to make it appear), and in the **Label** slot, rename the **Mix Shader** as `Mix Shader1`.
3. In the first **Shader** slot of this new **Mix Shader1** node, select a **Diffuse BSDF** shader node, and in the second one, select an **Add Shader** node; label this node as `Add SPEC`.
4. Add two **Glossy BSDF** shader nodes (press *Shift* + *A* and navigate to **Shader** | **Glossy BSDF**) and label them as `Glossy BSDF_1` and `Glossy BSDF_2`. Set their **Distribution** to **Ashikhmin-Shirley**, and then connect their output to the first and second **Shader** input sockets of the **Add SPEC** node respectively.
5. Add a **Fresnel** node (press *Shift* + *A* and navigate to **Input** | **Fresnel**) and connect it to the **Fac** input socket of the **Mix Shader1** node. Set **IOR** to `1.450`.
6. Press *Shift* + *D* to duplicate the **Mix Shader1** node, label the duplicate as **Mix Shader2**, and paste it between the **Mix Shader1** and the **Material Output** nodes.
7. Press *Shift* + *D* to duplicate the **Add SPEC** node, label the duplicate as `Add SSS`, and connect its output to the first **Shader** input socket of the **Mix Shader2** node, so that the connection that comes from the **Mix Shader1** node automatically switches to the second **Shader** input socket. Connect the output of the **Mix Shader1** node also to the second **Shader** input socket of the **Add SSS** node.
8. Add a **Subsurface Scattering** node (press *Shift* + *A* and navigate to **Shader** | **Subsurface Scattering**) and connect its output to the first **Shader** input socket of the **Add SSS** node. Set **Falloff** to **Gaussian**; **Scale** to `0.050`; **Radius** to `4.000`, `2.000`, and `1.000`; and the **Texture Blur** value to `0.100`, as shown in the following screenshot:



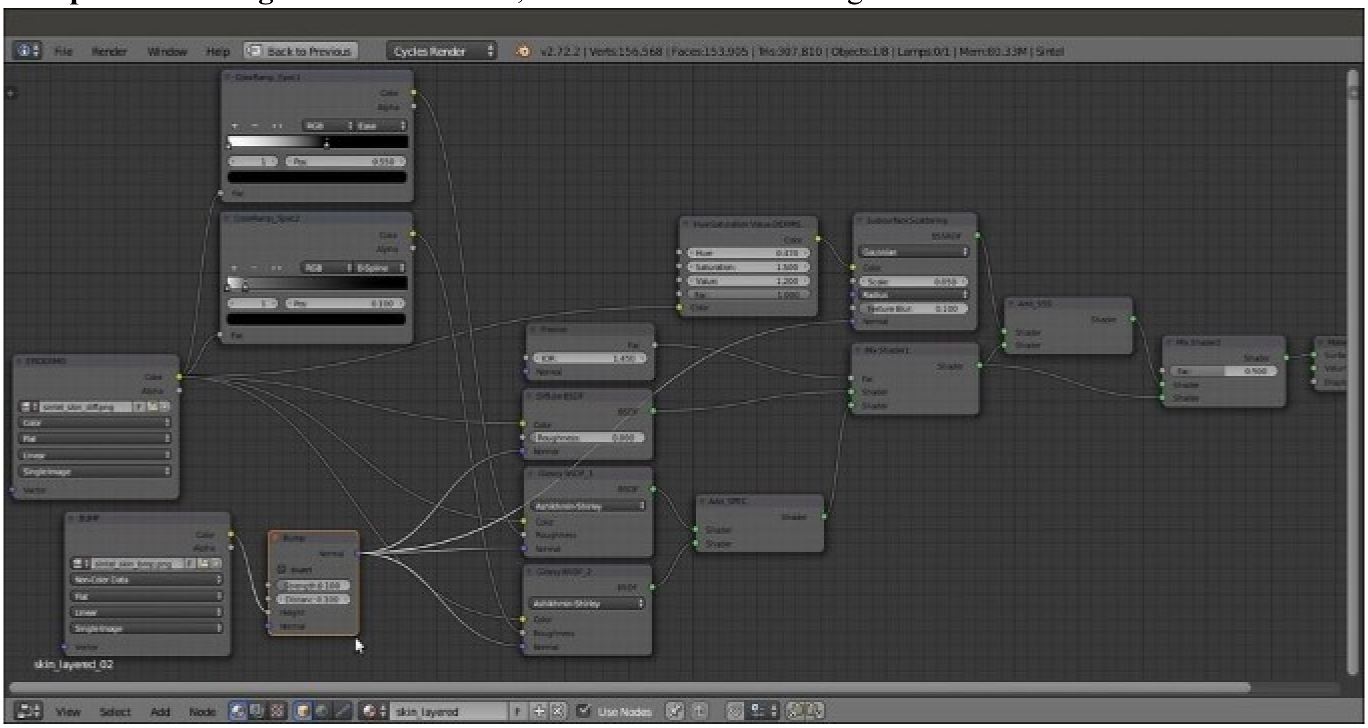
9. Add an **Image Texture** node (press *Shift* + *A* and navigate to **Texture** | **Image Texture**) and label it as `EPIDERMIS`; connect its **Color** output to the **Color** input sockets of the **Diffuse BSDF** and **Subsurface Scattering** nodes and the two **Glossy BSDF** nodes.
10. Click on the **Open** button of the **EPIDERMIS** image texture node, browse to the `textures` folder, and load the `sintel_skin_diff.png` image.
11. Add two **ColorRamp** nodes (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**) and label them as `ColorRamp_Spec1` and `ColorRamp_Spec2`. Connect the **Color** output of the **EPIDERMIS** node also to the **Fac** input socket of both the **ColorRamp** nodes.
12. Connect the **Color** output of the **ColorRamp_spec1** node to the **Roughness** input socket of the **Glossy BSDF_1** shader node; set **Interpolation** to **Ease**, and move the black color stop to the `0.550` position and the white color stop to the `0.000` position.
13. Connect the **Color** output of the **ColorRamp_spec2** node to the **Roughness** input socket of the **Glossy BSDF_2** shader node; set **Interpolation** to **B-Spline**, and move the white color stop to the `0.100` position and the white color stop to the `0.000` position, as shown in the following screenshot:



Sintel's color map is directly connected to the shader nodes but is modulated through ColorRamp nodes for the roughness of the glossy nodes

14. Add a **Hue Saturation Value** node (press *Shift* + *A* and navigate to **Color** | **Hue/Saturation**), label it as `Hue Saturation Value DERMIS`, and paste it between the **EPIDERMIS** and **Subsurface Scattering** nodes. Set the **Hue** value to `0.470`, the **Saturation** value to `1.500`, and **Value** to `1.200`.

15. Add a new **Image Texture** node (press *Shift* + *A* and navigate to **Texture** | **Image Texture**) and a **Bump** node (press *Shift* + *A* and navigate to **Vector** | **Bump**); label this **Image Texture** node as `BUMP`, and connect its **Color** output to the **Height** input socket of the **Bump** node, and the **Normal** output of this node to the **Normal** input sockets of the **Diffuse BSDF** node, of the two **Glossy BSDF** nodes, and of the **Subsurface Scattering** nodes.
16. Click on the **Open** button of the **BUMP** image texture node, browse to the `textures` folder, and load the `sintel_skin_bmp.png` image. Set **Color Space** to **Non-Color Data** and the **Bump** node's **Strength** value to `0.100`, as shown in the following screenshot:



The same color map modified for the SSS node and the bump map connected as per the shader bump

How it works...

In this recipe, we used a layered approach to build the human skin shader, but what does layered mean exactly?

It means that the shader tries to simulate the behavior of real human skin in the most effective possible way. I'm referring to the fact that the human skin is composed of several different overlapping and semi-transparent layers that reflect and absorb light rays in various ways, giving the reddish coloration to certain areas due to the famous subsurface scattering effect.

Now, a perfect reproduction of the real human skin model is not necessary; usually, it's enough to use different image maps for the key components of the shader, each one added on top of the other: the base color, the dermis blood layer, the specularity map, and the bump map.

In our case, we had at our disposal only two image maps, the `sintel_skin_diff.png` color one and the `sintel_skin_bmp.png` gray-scale map, which we used straight for the bump; we could have obtained the missing maps with the aid of an image editor (such as, for example, GIMP), but for the sake of this exercise, to obtain the required missing images, we used the nodes: so, starting from the **EPIDERMIS** layer, that is the color map, we obtained via the **Hue Saturation Value DERMIS** node the blood-vessel layer that lies beneath the epidermis, as shown in the following screenshot:

The normal color map and the blood-vessel version rendered separately

By the use of the two **ColorRamp** nodes and the two gray-scale versions for the specularity component, one sharp specularity map and a softer one are shown in the following screenshot:

The two different glossy maps obtained from the same color map and rendered separately

Then, the `sintel_skin_bmp.png` map has been connected to the **Bump** node for the per-shader bump effect.

Note that because we used the color map to obtain all the others, certain areas of the images are wrong; for example, the eyebrows, shown in pure white on the specularity maps, should have been removed. In any case, this doesn't show that much on the final render, and the result is more than acceptable.

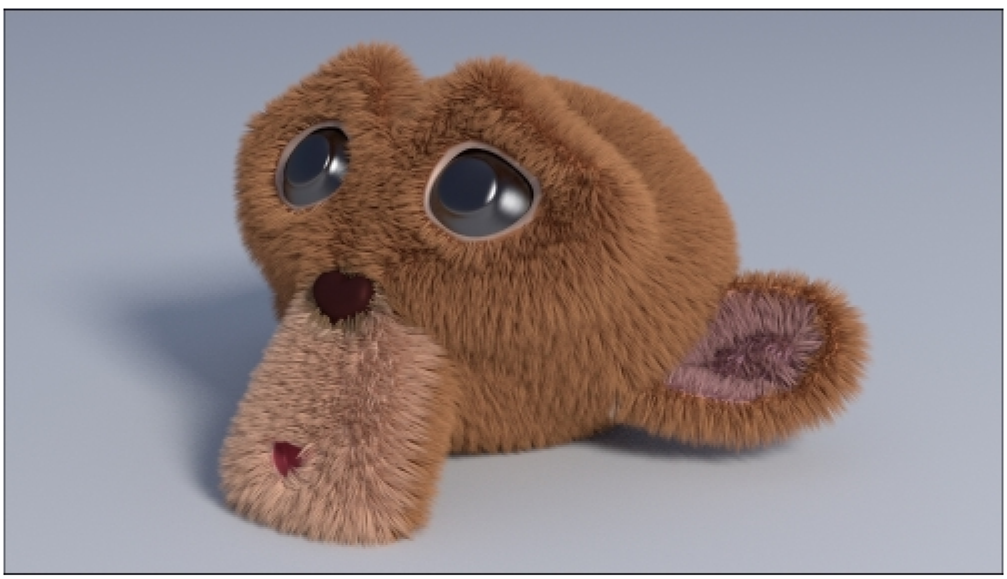
Creating fur and hair

Fur, in the world of computer graphics, is considered among the most difficult things to recreate, both because it's generally quite expensive from a memory management point of view (a single character can easily have millions of hair strands) and also because it can be quite a task to make a believable shader that can work under different light conditions.

Blender is not new to fur creation; the exact goal of the open movie *Big Buck Bunny* was to add tools for fur creation to the Blender Internal rendering engine, and it did it through a new type of primitive, strands, which have to be enabled in the **Particle** panel (the **Strand render** item); strands are very instanced on the particle system, but they can be edited, combed, and tweaked in several ways to obtain the best possible result.

Almost the same concept applies for the Cycles rendering engine; there's no need to enable the **Strand render** item anymore, because strands are rendered automatically by Cycles when the **Hair** item is selected as **Particle Type**.

In fact, once the **Hair** item's **Particle Type** has been selected, you will find two more subpanels at the bottom of the **Particle** window: **Cycles Hair Rendering** and **Cycles Hair Settings**. Here is a screenshot of the teddy bear Suzanne in the **Rendered** view:

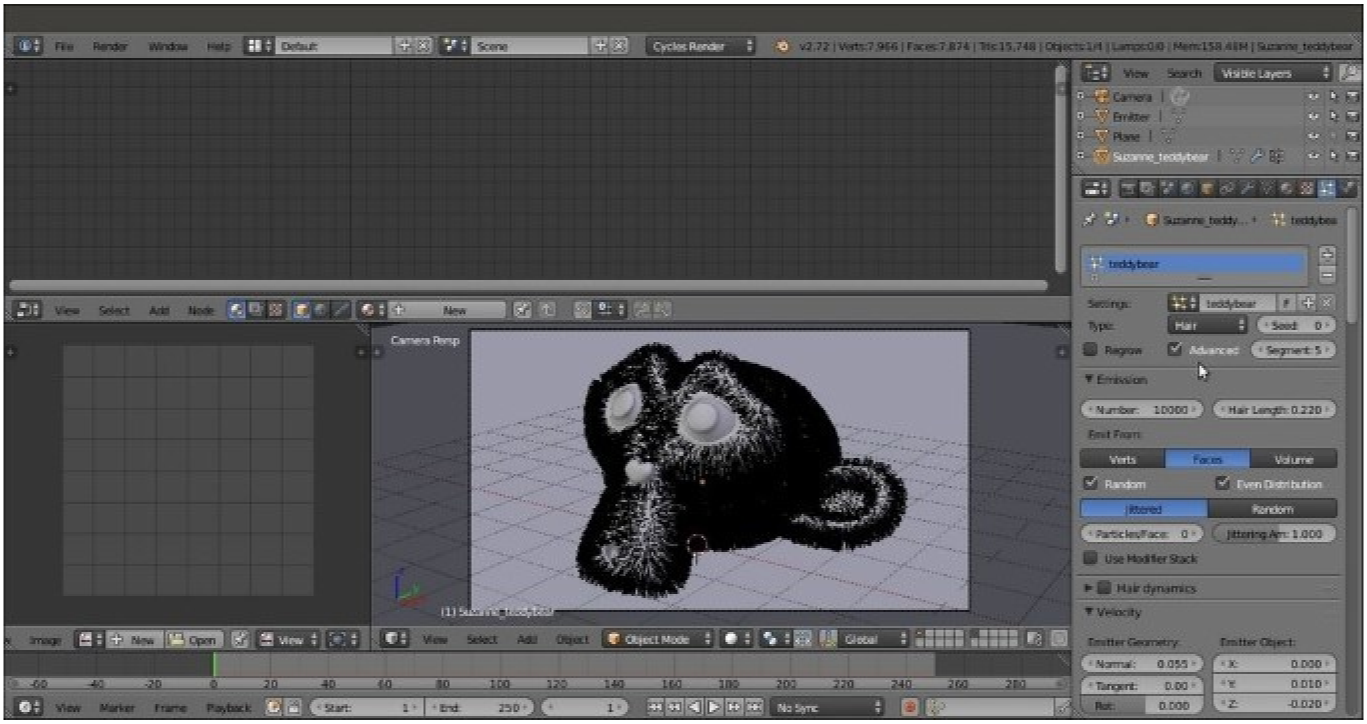


The Rendered teddy bear Suzanne

Getting ready

Start Blender and open the `9931OS_08_hair_start.blend` file; in the scene, there is a Suzanne primitive (**Suzanne_teddybear**) with a **Hair** particle system already named **teddybear** and set (go to see it in the **Particle** window) to resemble the fur of a cuddly toy.

The **Suzanne_teddybear** mesh is already unwrapped and has a **Vertex Group** named **density**, used in the **Particle** window (the **Vertex Groups** subpanel) to establish the **Density** distribution of the fur on the mesh (in short, to avoid fur on the eyes, the nose, and inside the mouth) as shown in the following screenshot:



A screenshot of the particle system as it appears in the Solid viewport shading mode and the settings to the left

How to do it...

We are going to add three different materials to the **Suzanne_teddybear** object: **base_stuff**, which is the basic material for the raw mesh, an eyes material, and the **teddybear** material for the fur, using the following steps:

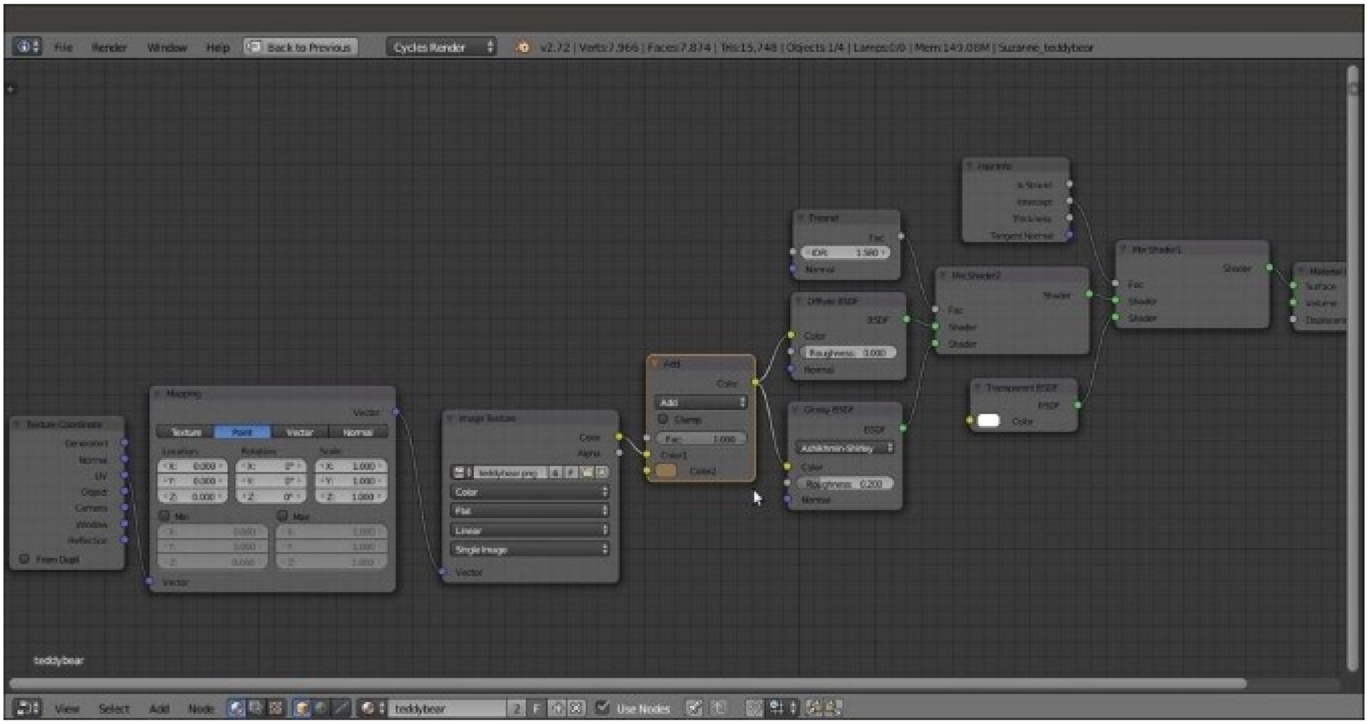
1. Select the **Suzanne** mesh and click on the **New** button in the **Node Editor** window toolbar or in the **Material** window to the right; rename the material as `base_stuff`.
2. Press *Tab* to go into **Edit Mode** and select the eyes vertices (put the mouse pointer over the interested part and press the *L* key to select all the linked vertices); click on the little **+** icon to the right of the **Material** window (add a new material slot) and add a new material. Click on the **New** button and rename the new material `eyes`, and then click on the **Assign** button. Press *Tab* to go out of **Edit Mode**.
3. Click again on the little **+** icon to the right of the **Material** window (add a new material slot) to add a third material (not to be assigned to any vertex or face; in fact, we are out of **Edit Mode**); click on the **New** button and rename the new material as `teddybear`.

4. Go to the **Particle** window at the top of the **Render** subpanel, and click on the **Material Slot** button (Material slot used to render particles), where at the moment, **Default Material** is selected instead of the `teddybear` material.
5. Go to the **Cycles Hair Rendering** subpanel to be sure that the **Primitive** item is set to **Curve Segments**, and set **Shape** to **Thick**; then, go to **Cycles Hair Settings** to be sure that the **Shape** value is `-0.50`, the **Root** value is `1.00`, the **Tip** value is `0.05`, the **Scaling** value is `0.01`, and the **Close Tip** item is checked.
6. Now, in the **Material** window, select the **base_stuff** material; in the **Node Editor** window, add a **Texture Coordinate** node (press *Shift* + *A* and navigate to **Input | Texture Coordinate**), a **Mapping** node (press *Shift* + *A* and navigate to **Vector | Mapping**), an **Image Texture** node (press *Shift* + *A* and navigate to **Texture | Image Texture**), a **Glossy BSDF** node, and a **Mix Shader** node (press *Shift* + *A* and navigate to **Shader | Texture Coordinate**; repeat similar steps to add other nodes).
7. Connect the **UV** output of the **Texture Coordinate** node to the **Vector** input socket of the **Mapping** node, and the output of this node to the **Vector** input socket of the **Image Texture** node. Paste the **Mix Shader** between the **Diffuse BSDF** and the **Material Output** nodes and connect the output of the **Glossy BSDF** shader to the second **Shader** input socket of the **Mix Shader** node.
8. Connect the **Color** output of the **Image Texture** node to the **Color** input socket of the **Diffuse BSDF** shader node and of the **Glossy BSDF** shader node; click on the **Open** button and browse to the `textures` folder to load the `teddybear.png` image (a simple color map painted directly in Blender). Set **Distribution** of the **Glossy BSDF** node to **Ashikhmin-Shirley**, the **Roughness** value to `0.300`, and the **Mix Shader** node's **Fac** value to `0.400`.
9. Back in the **Material** window, select the **eyes** material and switch the **Diffuse BSDF** shader with a **Mix Shader** node; in the first **Shader** slot, select a **Diffuse BSDF** shader, and in the second one, select a **Glossy BSDF** shader node.
10. Set the **Mix Shader** node's **Fac** value to `0.200`; change the **Diffuse BSDF** node's **Color** values for **R** to `0.010`, **G** to `0.003`, and **B** to `0.001`; and change the **Glossy BSDF** node's **Roughness** value to `0.100`.

    In the following screenshot, the **teddybear** particle system has been hidden by disabling the viewport's visibility in the **Object modifiers** window:

The base_stuff material in the Node Editor window and in the Preview

11. In the **Material** window, select the **teddybear** material and switch the **Diffuse BSDF** node with a **Mix Shader** node, and label it as `Mix Shader1`; in the first **Shader** slot, select another **Mix Shader** node, and in the second one, select a **Transparent BSDF** node.
12. Label the second **Mix Shader** node as `Mix Shader2`; then, in the first **Shader** slot, select a **Diffuse BSDF** shader node, and in the second one, select a **Glossy BSDF** shader node. Set the **Glossy BSDF** node's **Distribution** to **Ashikhmin-Shirley**, and its **Roughness** to `0.200`.
13. Add a **Fresnel** node (press *Shift* + *A* and navigate to **Input** | **Fresnel**) and connect it to the **Fac** input socket of the **Mix Shader2** node; set **IOR** to `1.580`. Add a **Hair Info** node (press *Shift* + *A* and navigate to **Input** | **Hair Info**), and connect the **Intercept** output to the **Fac** input socket of the **Mix Shader1** node.
14. Add an **Image Texture** node (press *Shift* + *A* and navigate to **Texture | Image Texture**), and connect its **Color** output to the **Color** input socket of the **Diffuse BSDF** node; click on the little arrows to the left of the **Open** button to select the already loaded `teddybear.png` image map.
15. Add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**), set **Blend Type** to **Add** and the **Fac** value to `1.000`, and paste it between the **Image Texture** node and the **Diffuse shader** node. Set the **Color2** values for **R** to `0.277`, **G** to `0.179`, and **B** to `0.084` and then connect its output also to the **Color** input socket of the **Glossy BSDF** shader node.
16. Optionally, add a **Texture Coordinate** node (press *Shift* + *A* and navigate to **Input** | **Texture Coordinate**) and a **Mapping** node (press *Shift* + *A* and navigate to **Vector** | **Mapping**), and connect the **UV** output of the **Texture Coordinate** node to the **Vector** input socket of the **Mapping** node and the output of the latter to the **Vector** input socket of the **Image Texture** node, as shown in the following screenshot:



The teddy bear material network; note the transparency driven by the Intercept output of the Hair Info node

How it works...

From step 1 to 3, we prepared the three materials to be used; we went into **Edit Mode** to assign the second material, **eyes**, to the eyes vertices of the mesh, and then we went back in **Object Mode** to add a third material that doesn't need to be assigned to any face of the mesh because they are only to be used for hair rendering.

In steps 4 and 5, we made sure that the right particle system settings for the material are to be rendered as fur.

From step 6 to 8, we built the `base_stuff` material, a simple basic shader made by the Diffuse and Glossy components mixed by the **Mix Shader** node and colored by the UV mapped `teddybear` image texture; note that the texture we used in this first material is also used to give the right color to the hair; it is useful to have it also on the underlying mesh, to cover any hole or missing part in the particle system.

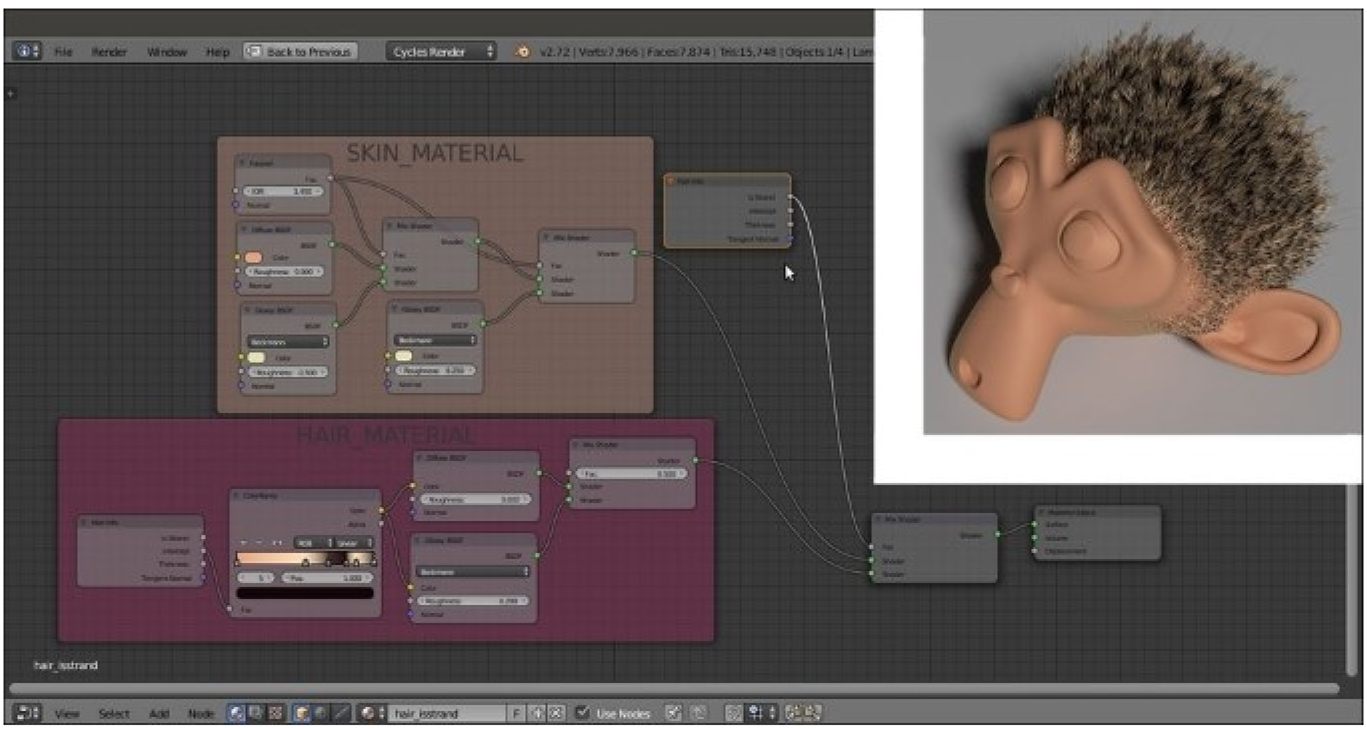
In steps 9 and 10, we built the `eyes` shader, which is again a very basic material made of the dark Diffuse color and the light gray Glossy components simply mixed by the **Mix Shader** node.

From step 11 to 16, we built the shader to be used by the particle system for the fur, mixing the already used `teddybear.png` image map, mapped on the UV coordinates, with a **MixRGB** node brownish color outputted to the usual **Diffuse/Glossy** basic shader; note that the **Diffuse/Glossy** shader is then mixed with the **Transparent BSDF** shader by the **Intercept** value of the **Hair Info** node along the length of each hair strand.

There's more...

The `teddybear.png` image texture has been used both in the `base_stuff` and in the **teddybear** materials; this is often not necessary, because in Blender, the particle system hairs get the textures from the surface they are emitted from, so it would have been enough to use the `base_stuff` material also for the fur (by selecting it in the **Material Slot** under the **Render** subpanel in the **Particle** window, because we had more than one material on the **Suzanne** mesh); we had to make a new and different material because we wanted to add a **MixRGB** brownish color to the UV-mapped image and we had to make the shader fade and become transparent towards the strands' tips.

Note that in the **Hair Info** node, there is also the Boolean **Is Strand** output that, similar to the outputs of the **Light Path** node (**Is Camera Ray**, **Is Shadow Ray**, and so on) can be used alternatively to the **Material** button in the **Particle** window to assign a material value of **0** to the emitter mesh and a material value of 1 to the fur strands (`9931OS_08_hair_isstrand.blend`) as shown in the following screenshot:



The set up for the hair_isstrand material and the rendered result

This also means that obviously we can also use different image textures to obtain fur materials different from the material of the particle emitter: for example, in the following screenshot, the `tiger.png` image texture has been used only for the fur, whereas the `base_stuff` material still uses the teddybear.png texture (and, honestly, this is blatantly visible... better to use the same image both for fur and emitter):

The rendered Suzanne_tiger object

The **Suzanne_tiger** object also has two different particle systems to create the fur, **tigerfur_long** and **tigerfur_short**, and three **Vertex Groups** to modulate the fur appearance, **density_long**, **density_short**, and **length**.

To take a look at the **Suzanne_tiger** object, open the 9931OS_08_tiger.blend file.

See also

- http://wiki.blender.org/index.php/Doc:2.6/Manual/Render/Cycles/Hair_Rendering
- http://wiki.blender.org/index.php/Doc:2.6/Manual/Render/Cycles/Nodes/More
- http://blenderdiplom.com/en/tutorials/all-tutorials/536-tutorial-fur-with-cycles-and-particle-hair.html
- http://cgcookie.com/blender/2014/04/24/using-cycles-hair-bsdf-node/

Creating a gray alien skin material with procedurals

In this recipe, we will create a gray alien-like skin shader as shown in the following screenshot, using Cycles procedural textures:

The alien Suzanne as it appears in the final rendering

Getting ready

Start Blender and open the `9931OS_08_alienskin_start.blend` file, where there is an already set scene with an unwrapped **Suzanne** primitive object.

The **Suzanne_unwrapped_alien** mesh has been modified by a shape key, to morph its monkey features into the head of a gray alien–like creature; in fact, in the **Object data** window, under the **Shape Keys** subpanel, there are the alien shape keys, with **Value** of `1.000`; sliding the slider towards `0.000` gradually restores the original Suzanne shape.

The **Suzanne** mesh also has a **Vertex Colors** layer named **Col** and is obtained by the **Dirty Vertex Colors** tool.

On the second layer, there are two Planes tracked (by a Damped Track constraint, in the **Object Constraints** window) to the Camera to stay perpendicular to its point of view; the **star_backdrop** object is used to create a simple star backdrop for our alien Suzanne, and the **star_backdrop.001** object is used simply to create something to be reflected by the alien-like Suzanne's eyes.

Press *Shift* + *F1* (or go through the **File** | **Append** main menu) to append the **SSS_group** node from the `9931OS_07_SSS_ngroup.blend` file.

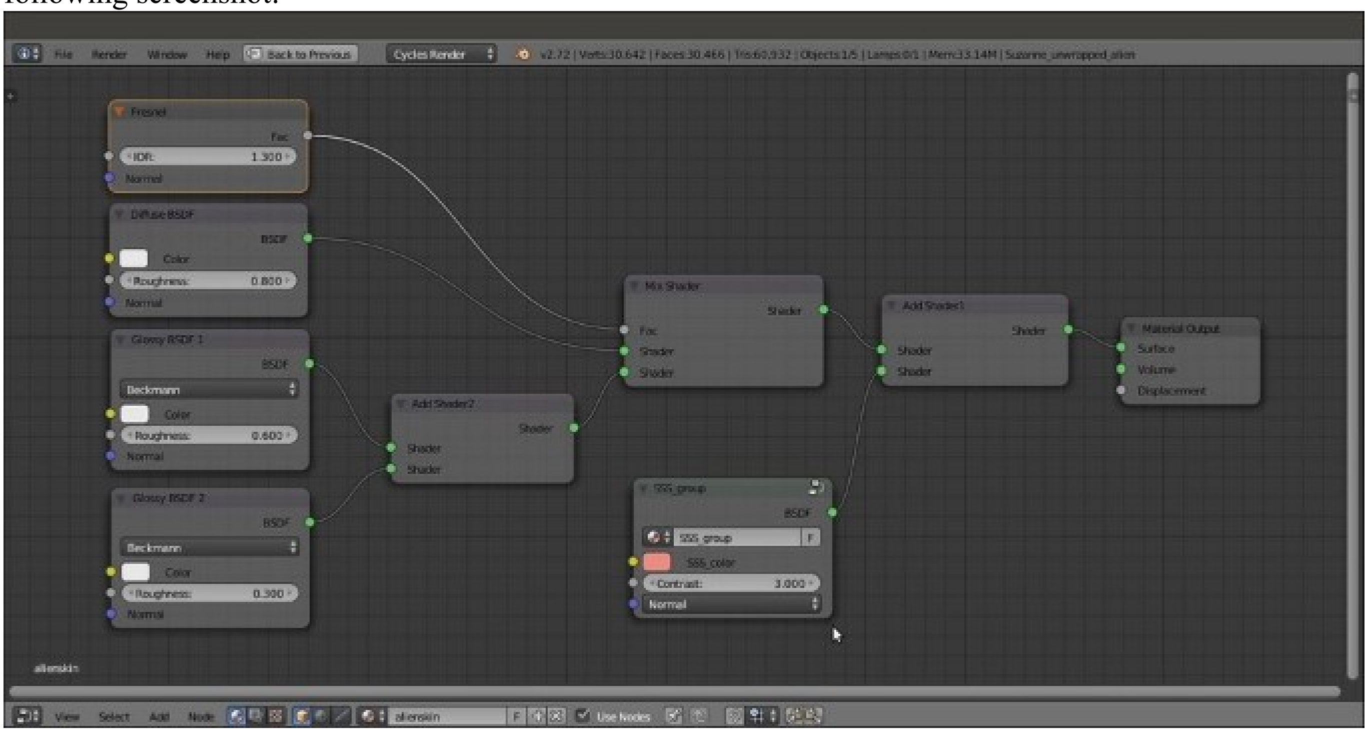
How to do it...

Let's start by first setting the background image material using the following steps:

1. Select the **star_backdrop** Plane and click on the **New** button in the **Node Editor** window toolbar or in the **Material** window. Rename the material `star_backdrop`, and in the **Material** window, switch the **Diffuse BSDF** shader with an **Emission** shader. Set the **Strength** to `0.500`.
2. Add an **Image Texture** node (press *Shift* + *A* and navigate to **Texture** | **Image Texture**) and connect the **Color** output to the **Color** input socket of the **Emission** node. Click on the **Open** button and browse to the `textures` folder and load the `centre-of-milky-way_tile_low.png` image.
3. Add an **RGB Curves** node (press *Shift* + *A* and navigate to **Color** | **RGB Curves**) and paste it between the **Image Texture** and **Emission** nodes. Click on the **curve** window to add a control point and set these coordinates: **X** to `0.36667` and **Y** to `0.12778`. Click again to add a second control point and set these coordinates: **X** to `0.65556` and **Y** to `0.81111`.
4. Add a **Mix Shader** node (press *Shift* + *A* and navigate to **Shader** | **Mix Shader**) and paste it between the **Emission** and **Material Output** nodes; switch the connection that comes from the **Emission** node to the second **Shader** input socket of the **Mix Shader** node; leave the first **Shader** input socket empty.
5. Add a **Light Path** node (press *Shift* + *A* and navigate to **Input** | **Light Path**) and connect the **Is Camera Ray** output to the **Fac** input socket of the **Mix Shader** node.
6. Go to **Outliner** and select the **star_backdrop.001** object; click on the double arrows icon to the left side of the data block name (*Browse Material to be linked*) in the **Node Editor** toolbar, and select the `star_backdrop` material; click on the **2** icon button to make it single-user.
7. In the new **star_backdrop.001** material, select the **Mix Shader** node and press *Ctrl* + *X* to delete it and keep the connection; then, also delete the **Light Path** node.
8. Go to the **Object data** window, and in the **Ray Visibility** subpanel, uncheck all the items except for the **Glossy** one.

   Now, let's get started with the creation of the alien skin shader (also with a different material for the eyes).
9. Select the **Suzanne_unwrapped_alien** object; click on the **New** button in the **Node Editor** window toolbar or in the **Material** window, and rename the material `alienskin`.
10. Go into **Edit Mode**, select the eyes vertices, and click on the **+** icon on the right of the **Material** window to add a second material. Click on the **New** button and rename the material as `alieneyes`; then, click on the **Assign** button to assign it to the selected vertices. Go out of **Edit Mode**.
11. Switch the **Diffuse BSDF** shader with a **Mix Shader** node; in the first **Shader** slot, select a **Diffuse BSDF** shader, and in the second one, select a **Glossy BSDF** shader. Set the **Mix Shader** node's **Fac** value to `0.600` and the **Diffuse BSDF** node's **Color** values for **R** to `0.010`, **G** to `0.006`, and **B** o `0.010`; set the **Glossy BSDF** node's **Distribution** to **Beckmann**, change the **Color** values for **R** to `0.345`, **G** to `0.731`, and **B** to `0.800`, and change the **Roughness** value to `0.100`.

12. Select the **alienskin** material, and in the **Material** window, switch the **Diffuse BSDF** shader with an **Add Shader** node (label it as `Add Shader1`); in the first **Shader** slot, select a **Mix Shader** node, and in the second one, load the appended **SSS_group** node. In this node, set the **Contrast** value to `3.000` and change the **Color** values for **R** to `0.834`, **G** to `0.263`, and **B** to `0.223`.
13. Go to the **Mix Shader** node, and in the first **Shader** slot, select a **Diffuse BSDF** node, and in the second one, select a new **Add Shader** node (label it as `Add Shader2`). Set the **Diffuse BSDF** node's **Roughness** value to `0.800`.
14. In both the **Shader** slots of the **Add Shader2** node, select a **Glossy BSDF** shader node; label the first one as **Glossy BSDF 1** and the second as **Glossy BSDF 2**; set **Distribution** of both to **Beckmann**, and then set the **Roughness** value of the first one to `0.600` and that of the second one to `0.300`.
15. Add a **Fresnel** node (press *Shift* + *A* and navigate to **Input** | **Fresnel**) and connect its output to the **Fac** input socket of the **Mix Shader** node. Set the **IOR** value to `1.300`, as shown in the following screenshot:



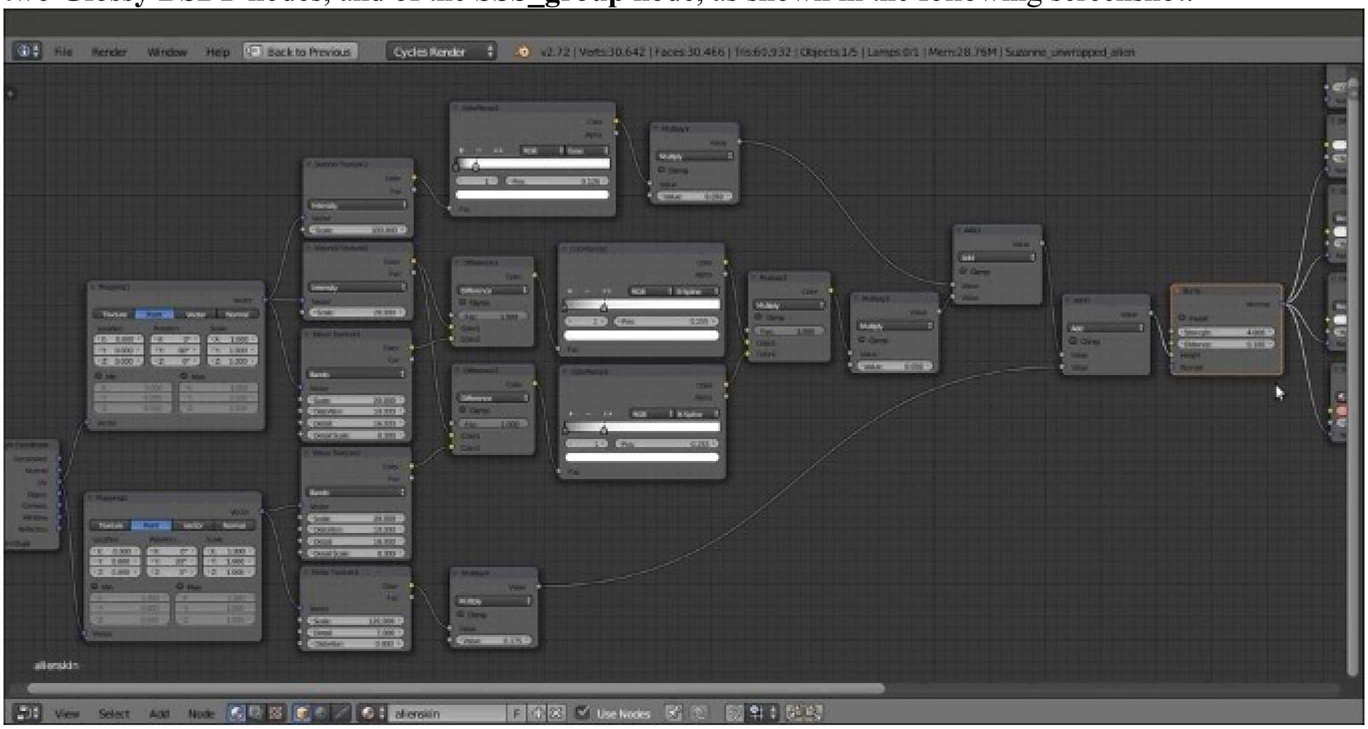
The basic shader network with the SSS provided by the appended node group

Now that we have set the basic shader for the alien skin, let's set an important component of the material, that is, the bump, by following these steps:

16. Add a **Texture Coordinate** node (press *Shift* + *A* and navigate to **Input** | **Texture Coordinate**) and two **Mapping** nodes (press *Shift* + *A* and navigate to **Vector** | **Mapping**); connect the **UV** output of the **Texture Coordinate** node to the **Vector** input socket of both the **Mapping** nodes, labeled as `Mapping1` and `Mapping2` respectively.

17. Set the **Rotation** value of **Y** of the **Mapping1** node to `60°`; set the **Rotation** value of **Y** of the **Mapping2** node to `20°`.
18. Add two **Voronoi Texture** nodes (press *Shift* + *A* and navigate to **Texture** | **Voronoi Texture**) and label them as `Voronoi Texture1` and `Voronoi Texture2`. Connect the **Mapping1** node output to both their **Vector** input sockets. Set the **Scale** value of the **Voronoi Texture1** to `100.000` and the **Scale** value of the **Voronoi Texture2** to `20.000`.
19. Add two **Wave Texture** nodes (press *Shift* + *A* and navigate to **Texture** | **Wave Texture**) and label them as `Wave Texture1` and `Wave Texture2`. Connect the **Mapping1** node output to the **Vector** input socket of the **Wave Texture1** node. Set the texture **Scale** value to `20.000`, **Distortion** to `10.000`, **Detail** to `16.000`, and **Detail Scale** to `0.300`.
20. Connect the **Mapping2** node output to the **Wave Texture2** node's **Vector** input socket, and set all the texture values exactly as in the previously described one.
21. Add a **Noise Texture** node (press *Shift* + *A* and navigate to **Texture** | **Noise Texture**) and label it as `Noise Texture1`. Connect the **Mapping2** node output to its **Vector** input socket, and set the texture **Scale** value to `120.000` and the **Detail** value to `7.000`.
22. Add a **ColorRamp** node (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**), label it as `ColorRamp1`, and connect the **Voronoi Texture1** node's **Color** output to its **Fac** input socket. Set **Interpolation** to **Ease** and move the white color stop to the `0.126` position.
23. Add a **Math** node (press *Shift* + *A* and navigate to **Converter** | **Math**), change **Operation** to **Multiply**, and label it as `Multiply1`. Connect the **Color** output of the **ColorRamp1** node to the first **Value** input socket of the **Multiply1** node, and set the second **Value** to `0.050`.
24. Add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**) and connect the **Color** output of the **Voronoi Texture2** node to the **Color1** input socket, and the **Color** output of the **Wave Texture1** node to the **Color2** input socket. Set **Blend Type** to **Difference** and the **Fac** value to `1.000`, and then label it as `Difference1`.
25. Add a second **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**) and connect the **Color** output of the **Voronoi Texture2** node to the **Color1** input socket, and the **Color** output of the **Wave Texture2** node to the **Color2** input socket. Again, set the **Blend Type** to **Difference** and the **Fac** value to `1.000` and label it as `Difference2`.
26. Add two **ColorRamp** nodes (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**), and label them as `ColorRamp2` and `ColorRamp3`; connect the **Difference1** node output to the **Fac** input socket of the **ColorRamp2** node, and the output of the **Difference2** node to the **Fac** input socket of the **ColorRamp3** node.
27. Set **Interpolation** to **B-Spline** for both of them, and for both of them, move the white color stop to the `0.255` position.
28. Add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**) and connect the **Color** output of the **ColorRamp2** node to the **Color1** input socket and the **Color** output of the **ColorRamp3** node to the **Color2** input socket. Set the **Blend Type** to **Multiply** and the **Fac** value to `1.000`. Label it as `Multiply2`.
29. Press *Shift* + *D* to duplicate the **Multiply1** node and label the duplicate as `Multiply3`. Connect the output of the **Multiply2** node to the first **Value** input socket of the **Multiply3** node. Set the second **Value** to `0.050`.
30. Press *Shift* + *D* to duplicate the **Multiply3** node and label the duplicate as `Multiply4`. Connect the **Color** output of the **Noise Texture** node to the first **Value** input socket of the **Multiply4** node, and set the second **Value** to `0.175`.

31. Add a **Math** node (press *Shift* + *A* and navigate to **Converter** | **Math**) and label it as `Add1`. Connect the output of the **Multiply1** node to the first **Value** input socket and the output of the **Multiply3** node to the second **Value** input socket.
32. Press *Shift* + *D* to duplicate the **Add1** node and label the duplicate as `Add2`; connect the output of the **Add1** node to the first **Value** input socket and the output of the **Multiply4** node to the second **Value** input socket.
33. Add a **Bump** node (press *Shift* + *A* and navigate to **Vector** | **Bump**) and connect the output of the **Add2** node to the **Height** input socket of the **Bump** node; set its **Strength** value to `4.000` and connect its **Normal** output to the **Normal** input sockets of the **Diffuse BSDF** node, of the two **Glossy BSDF** nodes, and of the **SSS_group** node, as shown in the following screenshot:

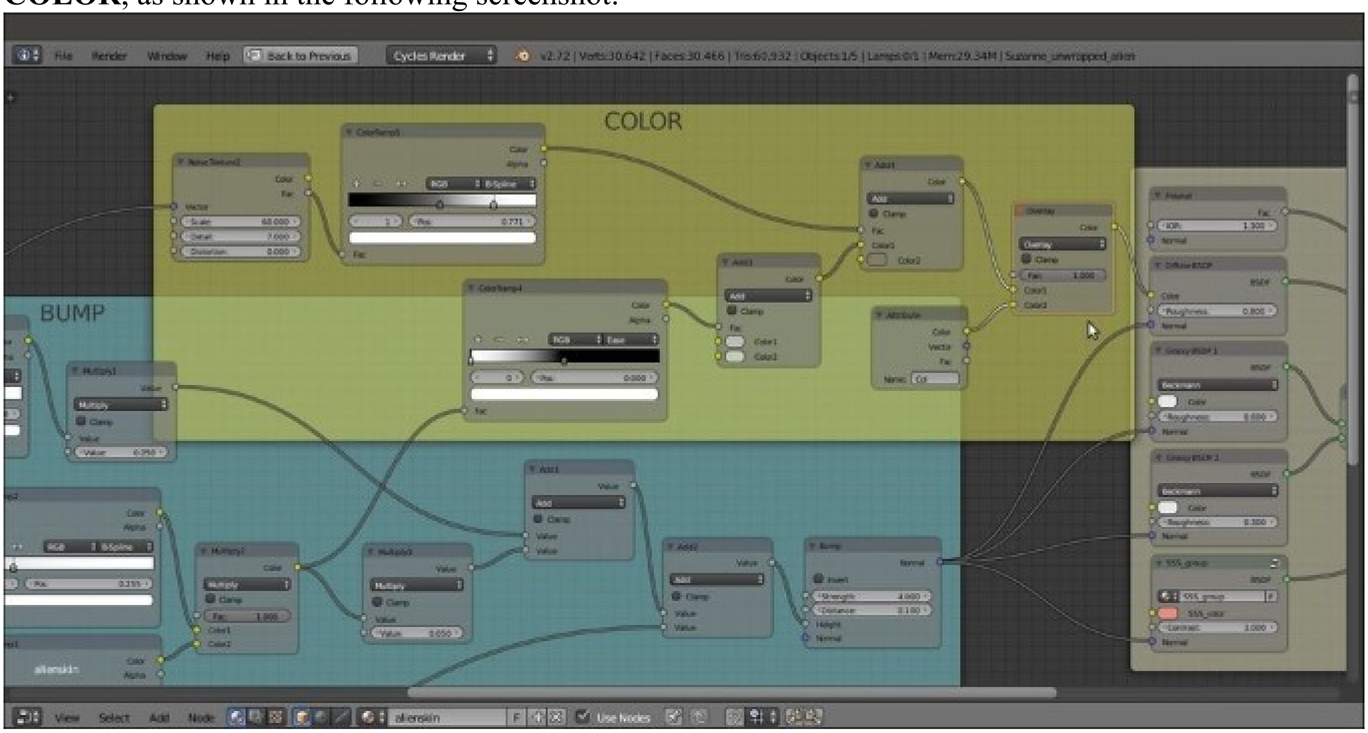


The apparently complex bump network to be connected as per the shader bump

We are done with the bump part, so now, let's set the color pattern using the following steps:

34. Add a **ColorRamp** node (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**), label it as `ColorRamp4`, and connect the **Color** output of the **Multiply2** node to its **Fac** input socket. Set **Interpolation** to **Ease** and move the black color stop to the `0.495` position, and the white color stop to the `0.000` position.
35. Add a **MixRGB** node (press *Shift* + *A* and navigate to **Color** | **MixRGB**), set the **Blend Type** to **Add**, and label it as `Add3`. Connect the **Color** output of the **ColorRamp4** node to the **Fac** input socket and set the **Color2** values for **R** to `0.553`, **G** to `0.599`, and **B** to `0.473`.
36. Add a **Noise Texture** node (press *Shift* + *A* and navigate to **Texture** | **Noise Texture**) and label it as `Noise Texture2`. Connect the **Mapping1** node output to its **Vector** input socket and set the texture's **Scale** value to `60.000` and the **Detail** value to `7.000`.

37. Add a **ColorRamp** node (press *Shift* + *A* and navigate to **Converter** | **ColorRamp**), label it as `ColorRamp5`, and connect the **Noise Texture2** color output to its **Fac** input socket. Set **Interpolation** to **B-Spline** and move the black color stop to the `0.486` position and the white color stop to the `0.771` position.
38. Press *Shift* + *D* to duplicate the **Add3** node, label the duplicate as `Add4`, and connect the **Color** output of the **ColorRamp5** node to its **Fac** input socket; connect the output of the **Add3** node to the **Color1** input socket and set the **Color2** values for **R** to `0.235`, **G** to `0.198`, and **B** to `0.132`.
39. Press *Shift* + *D* to duplicate the **Add4** node, label the duplicate as `Overlay`, and change **Blend Type** to **Overlay** as well. Set the **Fac** value to `1.000` and connect the output of the **Add4** node to the **Color1** input socket.
40. Add an **Attribute** node (press *Shift* + *A* and navigate to **Input** | **Attribute**) and connect its **Color** output to the **Color2** input socket of the **Overlay** node; in the **Name** field, write `Col` (the **Vertex Colors** layer).
41. Connect the output of the **Overlay** node to the **Color** input socket of the **Diffuse BSDF** shader node.
42. To make them more easily readable, frame the three groups of nodes, **SHADER**, **BUMP**, and **COLOR**, as shown in the following screenshot:



The simpler color pattern to be connected only to the Diffuse shader node and the nodes grouped by frames

43. Save the file as `9931OS_08_alienskin_final.blend`.

How it works...

- From step 1 to 8, we built a simple and quick shader for the starry background and for the Plane in front of the **Suzanne_unwrapped_alien** mesh to be reflected in the eyes; note that the background Plane material works as a shadeless material. To see how to set a bright but not emitting light background, that is, a shader that behaves as the shadeless material you have in the Blender Internal engine, go to Chapter 9, *Special Materials*.
- From step 9 to 15, we built the basic shader for the alien Suzanne's skin; the diffuse component is mixed and modulated by the **Fresnel** output, with a specular component made by two summed **Glossy BSDF** nodes with different roughness values, so as to have a crisper specular effect on a more diffuse one, and with the additional help of the **SSS_group** node to simulate a reddish *Subsurface Scattering* effect.
- From step 16 to 33, we built the quite complex bump pattern for the skin by mixing the outputs of three different types of procedural textures with the help of both the **Math** and **MixRGB** nodes, and the variations provided by the **ColorRamp** nodes.
- Finally, from step 34 to 41, a simple grayish color pattern is modulated through the **Dirty Vertex Colors** layer data that comes from the mesh and that uses the first part of the bump pattern to add variation.

Chapter 9. Special Materials

In this chapter, we will cover the following recipes:

- Using Cycles volume materials
- Creating a cloud volumetric material
- Creating a "fire and smoke" shader
- Creating a shadeless material in Cycles
- Creating a fake immersion effect material
- Creating a fake volume light material

Introduction

In this final chapter, we are going to see some special materials, that is, materials that can be used for special effects or for situations where very realistic results are not required, for example, creation of volumetric effects (fire, smoke, mist, volumetric light, and so on) and special materials to obtain peculiar results (shadeless images, alpha backgrounds, and so on).