Integumentary System

Pathology
Most people experience acne at some point in their lives and it’s especially common in teenagers. Acne is a bacterial infection of the sebaceous glands. Pimples form when a “plug” made of dead skin cells (stratum corneum) held together by large amounts of oily sebum clogs up the sebaceous glands. This traps a colony of bacteria (Propionibacteria acnes) in the gland, where they multiply and may rupture the wall of the gland. When this rupture occurs, the body responds with inflammation (heat, redness, pain and swelling): pimples.
Although some people try to change their diets to control acne, diet really has very little to do with acne. There are some things you can do to help minimize acne, though. One thing is to avoid touching your face if possible. This spreads oils on your face and may also spread the bacteria. In addition to that, keeping your face clean and exfoliated keeps the stratum corneum from collecting in the sebaceous glands and clogging them up.

In cases where acne is moderate-to-severe, facial scarring is a concern so medical treatments are called for. Sometimes antibiotics such as tetracycline or erythromyosin are prescribed to kill the bacteria, but concerns about overprescribing antibiotics as well as their side effects make them less commonly-prescribed today than they once were.

Sebum production can be controlled by certain medications that slow or stop the activity of the sebaceous glands. Accutane is a common example. The big problem with these sorts of drugs, though, is that since the skin isn’t producing much sebum, the skin becomes very dry, brittle, and flaky. Skin damage is a common result.

Finally, there are some drugs that make the sebaceous glands better able to withstand the bacteria. These drugs are fairly new, but are becoming more commonly-prescribed by dermatologists.
The cause of skin cancer is often unknown and genetics probably plays a role, but one major risk factor for skin cancer is exposure to ultraviolet radiation (sunlight, tanning beds, etc.) Over the past 20 years, skin cancer has become more and more common as people spend more time outdoors (often without sunblock) and wear less clothing in the sun. There are three types of skin cancer, which we'll examine separately.
The most common form of skin cancer is **basal cell carcinoma**. It occurs when cells in the stratum basale begin to reproduce out of control and invade the dermis. Most basal cell carcinomas form raised bumps easily visible on the skin. While these cells don't metastasize (move into other tissues) very often, a basal cell carcinoma will continue to grow without excision.
A squamous cell carcinoma is more dangerous than basal cell carcinomas. It occurs when cells of the stratum spinosum begin dividing – remember that normally only stratum basale cells in the epidermis divide. Squamous cell carcinomas grow faster than basal cell carcinomas, but they still grow relatively slowly. The risk of metastasis is greater, too.
Malignant melanomas are, by far, the most dangerous form of skin cancer. They form when melanocytes begin dividing out of control, often in an existing mole that’s been exposed to too much sunlight. Because malignant melanomas are fast-growing and metastasize easily, the survival rate for this form of skin cancer is very low (about 50%).
Because skin cancers (especially malignant melanomas) can be so dangerous, it's important to keep an eye on any existing moles or unusually pigmented areas on your body. If you notice changes, you should get a doctor's opinion right away. The “ABCD rule” tells some of the warning signs to look for and is summarized in the table above.
A burn is damage to tissue (particularly the skin) as a result of excessive heat or cold or exposure to dangerous chemicals (acids or bases), electricity, or ultraviolet radiation. We most commonly associate burns with excessive heat. Burns can be classified as either partial-thickness burns or full-thickness burns. A partial-thickness burn damages or destroys the epidermis and may damage part of the dermis, but it does not go all the way through the cutaneous membrane. A full-thickness burn destroys all of the epidermis and dermis in the affected area. It may also damage the hypodermis and underlying tissue (muscle, bone or cartilage) as well.

There are two huge dangers associated with severe burns: 1) Fluid loss. One of the major functions of the skin is to prevent fluid loss, so when large parts of the skin are compromised, major catastrophic fluid loss can occur, leading to severe dehydration and electrolyte imbalance. This is exacerbated by the fact that when tissue is damaged an becomes inflammed, blood vessels in the area increase their regional blood flow and become more permeable (pass more fluid and other substances.) 2) Infection. A second major function of the skin is to block pathogens. When the skin is compromised, pathogens can more easily get into the body’s internal tissues.
In addition to the partial-thickness/full-thickness distinction, we can classify burns in another way, based on severity.

A first degree burn is a burn that damages epidermis, but does not harm the dermis. Examples of first degree burns include sunburn, scalds from steam, the burns Mr. Derby routinely gets when mixing and aloquoting acids and bases for labs because he doesn’t always wear the proper safety equipment, minor contact burns, etc. (Note that all of these can progress to more serious burns if the damaging stimulus lasts long enough.)

Symptoms of a first degree burn include local redness, swelling and a lot of pain. Fortunately, first degree burns usually heal on their own in a few days since the dermis has not been damaged.
A second degree burn goes all the way through the epidermis and damages the more superficial part of the dermis. Prolonged exposure to any burning stimulus (ultraviolet radiation, heat, etc.) will cause a second degree burn. Symptoms include all of the symptoms of a first degree burn, but blisters also occur. This is because the dermis, which includes blood and lymphatic vessels, has been damaged. If the burn does not become infected (as can happen if the blisters break), second degree burns usually heal on their own in a few weeks with little or no scarring.
A third-degree burn is the most serious type of burn and is often life-threatening. In a third degree burn, the entire depth of the skin has been destroyed in the affected area. The epidermis and dermis have been destroyed, and underlying tissue may also be damaged. Since the nerve endings in the dermis have been destroyed in third-degree burns, the most severely-damaged areas do not feel pain (but the less-damaged areas on the periphery of the burn sure will!). The damage in third-degree burns is devastating. Cells, blood vessels and lymphatic vessels have been obliterated, leading to massive fluid loss and a huge risk of infection.

Without treatment, a patient with third-degree burns won’t likely survive due to the fluid loss and the risk of infection. Even with treatment, scarring is usually inevitable. In addition to treatment for fluid-loss and infection, treatment for a third degree burn includes skin grafting – replacement of the demolished skin with new, living skin. Back in the day, this was often done by removing a patient’s living skin from another part of the body (or even a cadaver if the patient didn’t have enough living skin left) and grafting it on to the burned area. Today, though, synthetic skin is becoming more and more common.

Burns are considered life-threatening when more than 10% of the body has third-degree burns or if there are any third degree burns on the face, hands or feet. (A large amount of second degree burns may also be considered life threatening.)
Burns are horrible things. This figure (from your book) shows a first, second, and third degree burn.
Because major burns are so life-threatening, health care professionals have developed a way to quickly assess the amount of damage. The rule of nines is a way of estimating the amount of skin surface that has been damaged, and therefore, the amount of fluid that has been lost from the body. Note that the rule of nines does not take into account secondary damage, such as damage to respiratory passages.

Using the rule of nines, each of 11 major body areas counts for 9% of the total body surface area: the head, the right and left upper limbs, the anterior part of each lower limb, the posterior part of each lower limb, the upper and lower parts of the anterior trunk, and the upper and lower parts of the posterior trunk. This gives us 99%. An additional 1% is accorded for the genital region.

For example, if someone has been wading around in sulpheric acid (seen the movie Dante’s Peak?), both of her lower limbs will be burned (anterior and posterior sides). According to the rule of nines, this would be 36% -- definitely life-threatening! If someone has a burn to the ventral side of one upper limb only, the rule of nines tells us that 4½% of the body surface is damaged.