MEDICINE

Funky Feet

By CATHERINE DODDS, M.D.

TURNERS FALLS – As beach season approaches, it's time to talk about feet. In my work as a primary care doctor, I see a lot of feet, and feet tell a lot about a person.

Every step of our lives is measured and reflected in our feet. There's also a lot of embarrassment about feet. I always reassure patients – I've seen worse. If you recognize your feet in the descriptions below, know that you are not alone.

Here are several common foot conditions that I see all the time:

Bunions are bony knobs that stick out from the side of the big toes. A similar bump sticking out on the other side of the foot near the pinkie toe is called a bunionette. Bunions affect 25 to 35% of people – yes, in a group of four people, one of you probably has a bunion.

Bunions develop because of how you're built (genetics, anatomy) and how you move, including what shoes you wear and how much of your life you've spent on your feet. Bunions are usually best treated with larger shoes to give them room and avoid pressing on them. Severe bunions can be surgically corrected if they're causing a lot of pain or difficulty walking.

Flat feet (*pes planus*) are exactly what they sound like – the soles of the feet are flat, or nearly so, instead of having the usual arch in the middle. Flat feet can lead to pain with walking, knee and hip arthritis, and increased risk for falls over the years. Flat feet are managed with orthotic inserts in the shoes to help create an arch and better align the joints of the legs when walking.

Plantar warts are raised, circular, flat-topped, sometimes painful skin lesions that can form anywhere on the sole of the foot. Sometimes there's only one, sometimes there's many. Warts can be treated with topical salicylic acid (as in Compound W) or by freezing them in a doctor's office (cryotherapy), which often requires multiple treatments and can be pretty sore for a few days as you continue to walk on the treated wart.

Regardless of what treatment is used, the goal of treatment is actually not to destroy the wart, but rather to damage the skin around the wart so that the body's immune system is activated to go after the HPV (human papillomavirus) that lies deep inside the wart, using the visible wart top as a protective shell.

Toenail fungus (*onychomycosis*) is reported to affect 3% to 5% of people, but this is likely an underestimate, as it's often not medically evaluated or treated. Onychomycosis can range from a slight yellowing of one toenail to severe yellow discoloration and thickening of all ten. Treatment is challenging – it's hard to get rid of that fungus once it's settled into the nail. But mild astringents like tea tree oil, apple cider vinegar, or Vicks VapoRub are often used. Prescriptions like ciclopirox gel or terbinafine pills can also be tried, though they aren't much more successful. Whatever treatment is chosen, patience is the most important part. It can take up to a year for a toenail to grow out fully, even if the treatment does work.

Foot fungus, also known as *tinea pedis* or athlete's foot, shows up in several ways. It can cause a raised, red, itchy rash anywhere on the foot. It can also be a thick white rash between the toes that can lead to pain and bleeding. It can also cause heel cracking or foot skin fissuring. The fungus finds its way to infect us when we walk barefoot, particularly in locker rooms or public swimming pools. It then stays in shoes and thrives when our feet are warm, moist, or infrequently cleaned.

Effective treatment is available in the form of antifungal powders, creams, or pills. However, prevention is key – keeping feet clean, dry, and cool and changing shoes regularly will prevent foot fungus from infecting us again.

It All Starts With One Cell

By OLIVIA MACRORIE

AMHERST – Flies, humans, and whales all share the amazing ability to transform from a single cell, hardly visible by eye, into much larger, multicellular structures, ranging from a few thousand cells in a fruit fly to tens of trillions in humans, or even up to a hundred quadrillion cells in the blue whale, the biggest animal known to have lived.

The detailed underlying mechanics of how single cells transform into a myriad of different cell types, eventually creating highly organized forms such as us, are not totally worked out. Researchers are still investigating chemical signals which lead to different cell types forming in the developing liver, for example. Embryology is a fascinating field that seeks to answer these types of questions, shedding light on the vastly complex processes that coordinate to produce a healthy organism.

Humans have been intrigued by embryo development for centuries, initially studying chick development as far back as 350 BC. From early observational studies, we gained insight into the changes in shapes and structures that occur throughout gestation.

As time has progressed and technology advanced, researchers have investigated chemical and bio-chemical signals that drive these changes in shape and structure. While it may not seem apparent, there are ties between the processes that occur in embryo development and cancer, making their study interesting from both basic understanding and disease perspectives.

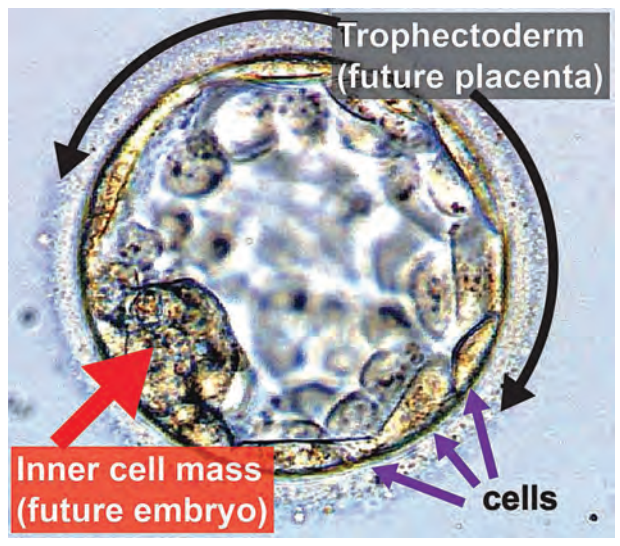
Development in humans follows a series of steps, lasting about nine months in total. Initially, an *oocyte*, or egg cell, is released from the mother's ovaries into the fallopian tubes. Then a sperm cell fuses with and enters the egg cell, a process called fertilization. At this point, day one post-fertilization, the first cell is formed from a combination of genetic material from the sperm and the egg, and is known as the *zygote* cell.

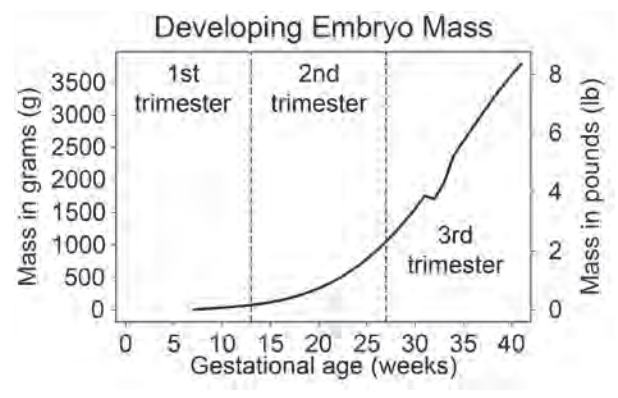
By the end of day two, that zygote cell copies its genetic material and divides into two "daughter" cells. These cells each continue to duplicate themselves, and after four or five division cycles have formed a tightly bound clump of around 20 to 30 cells by day three.

These "compacted" day three cells form what is known as the *morula*, which is followed by the formation of the *blastocyst* at day five, a mostly hollow spherical structure composed of about 60 cells and roughly 0.2 mm in size.

At this point the blastocyst has two different cell types, cells that will form the embryo and cells that will later form the placenta and other extra-embryonic structures, as shown in the accompanying graphic.

By day seven, the embryo implants into the mother's uterine wall, changing the structure of the surrounding uterine tissue in a process called *decidualization*. Subsequently, the embryo goes through a reorganization process called *gastrulation*, which forms the three major layers of the embryo – the ectoderm, the mesoderm, and the endoderm. These layers will go on to form specific organs. For example, the liver and pancreas are derived from the endoderm.





Top: *A microscope image of a human "blastocyst" taken five days post-fertilization, in the pre-implantation stage.*

Bottom: *The mass of a developing human embryo over the gestational period. The boundaries between trimesters are indicated with dashed lines at 13 and 27 weeks.*

After gastrulation is the development of the major organs, or *organogenesis*, and placenta development. The placenta is functional at 12 weeks, providing nutrients to the embryo, and weighs approximately two ounces. During this period of time, the fetus undergoes a great amount of growth, as seen in the figure.

Looking into the changes that happen within a developing embryo is no easy task, given technical challenges and ethical problems. Despite this, it is my belief that it is a worthwhile endeavor for scientists, and maybe an interesting topic for non-scientists who weren't quite satisfied with the answer they got to the "Where did I come from?" question.

For those interested in how development relates to cancer, one example is that there are a number of similarities between the extra-embryonic trophoblast cells and cancer cells. Placenta-forming trophoblast cells must divide rapidly and become more mobile in order to "invade" the mother's uterine lining, a behavior that cancerous cells often also share. Understanding how the trophoblast cells change in order to promote their migratory/invasive state may provide insight into changes that occur in cancer cells before and during metastasis.

EDITORIAL

The Court's Big 'Choice'

By SPENCER SHORKEY

MILLERS FALLS – Last month, a leaked Supreme Court opinion suggested that abortion rights are not protected by the Constitution and not rooted in US history. If this judgment by the Court comes to pass, it would overturn the precedent set nearly half a century ago by *Roe v. Wade*, which held that the right to an abortion is protected by the Constitution. In light of this probable change in course by the Court, the May 20 edition of *Science* magazine featured an editorial titled "The Court is ignoring science" by Diana Greene Foster, a professor of reproductive science at University of California San Francisco.

Prof. Foster worked on the Turnaway Study, a study designed to "rigorously examine the effects of receiving versus being denied a wanted abortion on women and their children." This study covered 30 abortion facilities, and included participants who received abortions and those who were denied abortions due to facility gestational age limits, tracking their outcomes.

The study revealed statistically significant trends. Women who were denied abortions had "four times higher odds of being below the federal poverty level" as well as physical and mental health risks. It was also found that "existing children of women denied abortions were more than three times more likely to live in households below the federal poverty level and they were less likely to achieve developmental milestones."

In this regard, Prof. Foster wrote that since "the majority of abortion patients are already parents, this means that being able to obtain an abortion has powerful, multigenerational impacts." In short, if the right to choose an abortion is overturned by the Court, there will surely be more children and mothers living in poverty as a result.

Prof. Foster concluded the editorial by writing: "Science is clearly relevant to the controversial issues of our time, including abortion access in the United States – in fact, science is especially critical in these moments. The highest court in the United States should not ignore it."