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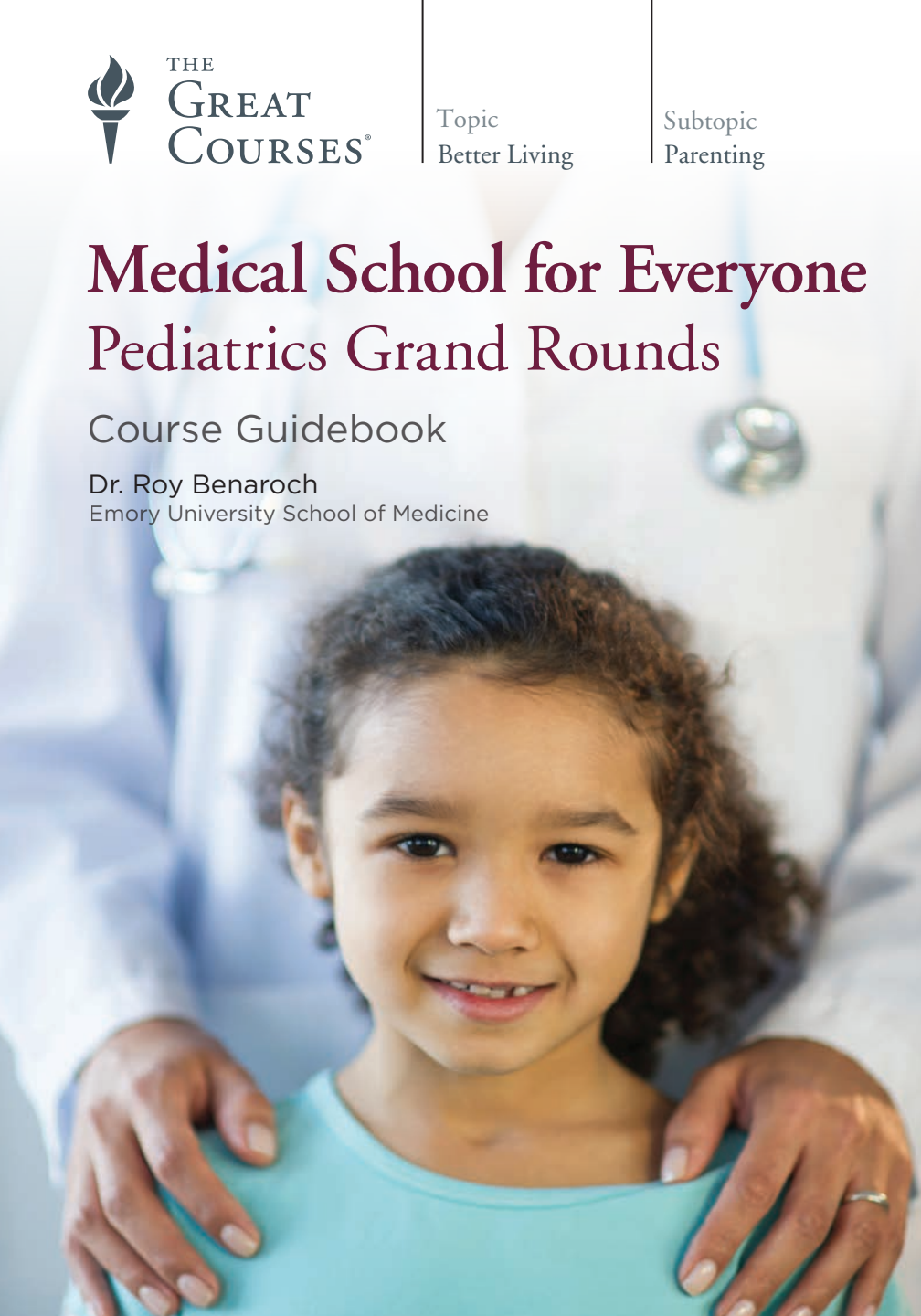
Pediatrics Grand Rounds
Course Guidebook

Dr. Roy Benaroch
Emory University School of Medicine



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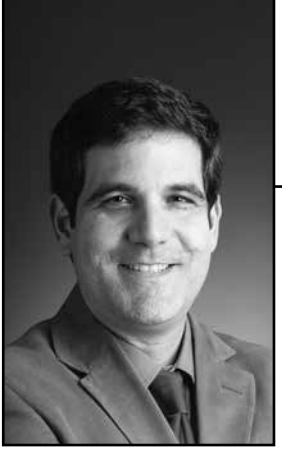

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Dr. Roy Benaroch is a general pediatrician, an author, and an educator. He earned his bachelor of science degree in Engineering at Tulane University, followed by his medical degree at Emory University. He completed his residency through the Emory University's affiliated hospitals in 1997, serving as chief resident and instructor of pediatrics in 1998. He has continued his involvement on the Emory faculty as an Adjunct Assistant Professor of Pediatrics. Dr. Benaroch was board certified in general pediatrics in 1997 and works in full-time pediatric practice near Atlanta, Georgia.

In addition to his clinical responsibilities, Dr. Benaroch teaches medical students and residents at his practice and gives regular lectures to physician's assistants at Emory University.

Dr. Benaroch has published two books on parenting and pediatric health topics: *Solving Health and Behavioral Problems from Birth through Preschool: A Parent's Guide* and *A Guide to Getting the Best Health Care for Your Child*. He also has authored two book chapters in *Visual Diagnosis and Treatment in Pediatrics*. Dr. Benaroch has a blog for parents and health professionals at pediatricinsider.com. His essays on pediatric health have been widely published on the Internet, and he has served as a featured expert on WebMD.com.

In addition to his work in private practice and as a teacher and writer, Dr. Benaroch also serves on the Board of Directors of the Cobb Health

Futures Foundation, a nonprofit group dedicated to public health for people of all backgrounds, and The Children's Care Network, a clinically integrated network of more than 1,000 Atlanta-area pediatric care providers.

Dr. Benaroch's other Great Courses are *Medical School for Everyone: Grand Rounds Cases* and *Medical School for Everyone: Emergency Medicine*. ■

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Scope

Medical School for Everyone: Pediatrics Grand Rounds

A sick child is among the scariest situations anyone has to face—a parent, a teacher, a bystander, or even a physician. Most children are healthy and well, but when they do get sick they can get very sick, very quickly. What makes children and their health needs so unique?

In *Medical School for Everyone: Pediatrics Grand Rounds*, you'll join a pediatrician mentor to learn about children's health the way it's taught in medical school. In this course, you are the medical student, learning through fascinating case presentations as they unfold from initial symptoms and their workup, to the diagnosis, and to treatment.

Every patient is a story, and in the story you'll find the clues to every diagnosis. Meet a teen with a mysterious swelling in his neck, and a case of unexplained abdominal pains. Why is a baby making a funny, squeaky noise when she breathes, and what sorts of problems cause a chronic cough?

Babies, children, and teenagers sometimes have concerns that extend outside of the traditional realm of medicine. You'll learn about the best way to tackle sleep problems for the whole family, and how to apply simple, easily learned tools to almost any behavior problem.

Pediatrics is a special branch of medicine because children are so unique. Though they're almost all healthy, they're also at the same time more vulnerable to many health problems—from infections to the effects of toxic stress on their environment. Keeping a child healthy doesn't mean maintaining the status quo. By their nature, children must grow and develop to thrive. Good pediatric care isn't just about treating illness—it's about

making sure children have every opportunity to make the most of their lives as they become adults.

Some health concerns straddle the line between medicine and psychiatry. Why would a girl suddenly get so irritable, and how should parents and teachers approach students who are failing at school?

Some of the lessons of pediatrics apply equally well to adult medicine, too. Pediatric care providers are committed to the prevention of disease through good nutrition, safe households, and the crucial protection provided by vaccines—steps that are, in a way, critical for all of us. We've learned that brain development doesn't just stop at 18. "Children of all ages" includes all of us, and we all need to continue to learn new things to stay truly healthy.

The best way to practice pediatrics is to follow a child all the way from a newborn to a young adult. You'll see how that creates not only a trusting bond, but also a rich source of information to help clinicians know when something has gone wrong. You'll learn how the youngest premature babies can be helped make their transition to life outside the womb, and how babies adopted from overseas have their own unique medical needs.

Many childhood diseases are minor and common—like ear infections, a sore throat, or coughing. You'll learn not only the best way to deal with common problems, but also when to worry about genuinely rare things—things doctors might not ever see in their own careers, but still need to keep in mind. There are many practical lessons here, too—how to take medications like antibiotics safely, and when to worry about whether your child is eating enough or growing tall enough.

This course will give you unparalleled insight into children's health and the practice of pediatric medicine. You'll be better prepared to take care of your own children or grandchildren—and better able to take care of yourself. We were all children once, and there's still a child in all of us. This course is a way to learn to take care of the children in your lives, and in your own heart. ■

Lecture 1

Fever: Then and Now

In this course, you'll be playing the role of a third-year medical student guided by a clue-giving doctor. It's time to start your pediatrics rotation. To set the stage, we'll start with a patient you've heard of: Helen Keller. Ms. Keller was born with sight and hearing, but those abilities were robbed from her by a febrile illness—that is, an illness that included fever—at 19 months of age. How did fever make her so sick, leaving her blind and deaf? What would have happened to the same child, with the same symptoms and the same illness, today? Let's find out together.

Meeting Helen

- Today, we're seeing pediatric patients in an emergency department. Our last patient of the shift is another 19-month-old, a modern girl named Helen. Her mother brought her here because she's worried about her child's fever.

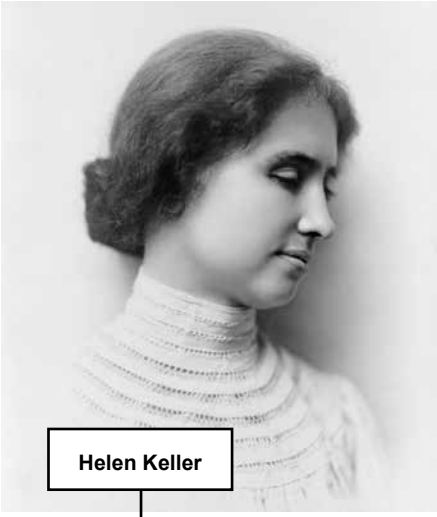
- Helen, we learn, had been feeling well until the middle of the night, about 12 hours ago. Her mom measured a temperature of 101.7 degrees Fahrenheit. She gave Helen a dose of acetaminophen (which often goes by the brand name Tylenol). After a little while, Helen fell back asleep.

- This morning, she awoke again with a temperature, which, again, seemed to improve after acetaminophen. But she later threw up her breakfast, so her mom brought her in to see us. Helen has had no other symptoms—no cough, no runny nose, no diarrhea.

- We don't have a lot of history, here—Helen had an elevated temperature of 101.7 degrees, and she threw up once—but that's enough to start with. Let's move on to our physical exam, to see

what clues we can find there.

- A first, gestalt look at a child often will tell you if they're sick or well. A sick child acts sick: not perky, not smiling, and not interacting. Even sullen teenagers will be interactive if you can engage them in conversation—and if a child of any age isn't interactive, that's an important red flag.



Helen Keller

- Back to Helen: She's sitting in her mom's lap, leaning away from you, and her eyes look glassy. She looks about half asleep. We know, from just a few moments of observation, that she is sick. This is not how a 19-month-old typically behaves. Pediatricians sometimes use the word *toxic* to describe a child like this—listless, not interactive, sleepy, and withdrawn.

- Helen now lets us take vital signs. She has a temperature of 102.3 degrees, pulse of 140 beats per minute, and a respiratory rate of 36 breaths per minute. The pulse and respiratory rates are high, though not unexpectedly high for that amount of fever. Fevers always drive up the heart and respiratory rates.

- In Helen Keller's case, in 1882, the story was about the same as what we've heard today: a 19-month-old girl, with fever and probably vomiting. Helen Keller was diagnosed with "acute congestion of the stomach and brain," which, to the thinking of 19th-century physicians, fit her symptoms well. *Congestion*, then, was a broad term referring to excessive fluids in the body tissue,

or in a specific organ. Often, the excessive fluid was blood, or was thought to be blood.

- Let's make a problem list for our present-day Helen:

    1. Fever

    2. Sleepiness, or a depressed level of consciousness

    3. Vomiting.

    - Of these three, the one that demands the more urgent attention is number 2: She's not acting right. In pediatrics and adult medicine, that is a big red flag.

Potential Causes of Sleepiness

- One potential cause of sleepiness is the fever itself. Though fevers by themselves can't harm anyone, they do make children and adults feel achy, uncomfortable, and unwell. We'll give Helen a dose of a fever-reducing medicine.

- Another potential cause of Helen's sleepiness is dehydration. If Helen is more than mildly dehydrated, she may not have enough circulating blood volume to get enough oxygen and nutrients to her brain, which can make her act sleepy. The medical term for this is *hypovolemic shock*—inadequate blood volume, providing inadequate tissue circulation, leading to symptoms of organ dysfunction.

- Assessing the hydration status of a child is especially important because children are more prone than adults to become dehydrated when they're ill. Some dehydration signs to look for are:

    - Sleepiness or inactivity.

    - A dry, tacky mouth or warm, dry skin.

- Infrequent urination or urinating very dark or amber-colored urine.

- The *capillary refill*: You squeeze or press on a toe, and then watch how long it takes for the color to come back. A capillary refill time of two seconds or more suggests circulation is poor, and in children that's often, though not always, caused by dehydration.

- Weight loss: If we knew Helen's exact weight a few days or a week ago, we can compare it with today's weight to estimate her fluid loss. (One pint of fluid = one pound.)

- We don't have a recent weight, but our clinical impression is that Helen is acting quite sleepy, with a delayed capillary refill. This is consistent with significant dehydration—but in a way, the story doesn't fit. After all, she has only vomited once, and she's only had the fever for about 12 hours. How did she get so dehydrated this fast?

- It's time to get an IV started to run in fluids. We don't know the whole story, yet, but we know Helen's acting sleepy and has findings suggesting dehydration, or maybe something else on top of that.

Further Measures

- Before starting the IV, we try to repeat the exam again. Her vitals now include an increased heart rate of 160 and a lower temperature of 100.7. Her capillary refill remains slow, and her neck has become stiff.

- All of this suggests a significant infection. It could be an abscess or infection in her neck, though those usually arise as a complication of a throat infection, and she never really had a sore throat.

- Or, more ominously, Helen may have meningitis, an infection in the tissues around her brain. In retrospect, meningitis is the most

likely diagnosis for what happened to Helen Keller, too. But lucky for our Helen, it's not 1882.

- With a nurse's help an IV is started, and you're dismayed to see that Helen barely flinches from the needle. Blood is drawn for testing, and then an intravenous catheter is left in place to administer fluids and antibiotics.

- We haven't tested Helen for meningitis yet, but this is a case where therapy cannot wait. We give the antibiotics to treat potential meningitis, now, even before performing the spinal tap.

- The first blood test occurs at the bedside, checking for blood glucose. *Hypoglycemia*, or low blood sugar, can cause listlessness, though Helen's comes back OK. Let's let the fluids and antibiotics run in for a few minutes. We'll repeat a set of vitals, too, and then see how Helen is acting after what's called a *fluid bolus*.

Background on Fevers

- There's some evidence, at least in animals, that fever helps the body successfully fight off infections. That's less clear in humans, especially humans in the developed world who have access to health care, clean fluids, and antibiotics. Whether or not fever genuinely helps fight infection in a significant way, we know it has some downsides: It can worsen dehydration, and it just makes a child feel bad.

- The cause of fevers has changed since Helen Keller's time. Fevers used to be caused by many serious infections that we don't have to worry about now: polio, hepatitis, measles, and many bacteria that cause blood poisoning are now very rarely seen, thanks to vaccines.

- In the developed world today, fever in children older than 2-3 months is almost always caused by a viral infection that will go away on its own. All you need to provide is comfort care for a

few days, after a careful assessment confirms there's no likely bacterial or other treatable cause of the fevers.

- We do have to worry enough to make sure that kids get vaccinated, to prevent these diseases from coming back. With our Helen, even though she's been completely vaccinated, we still need to be careful. Vaccines are never 100% effective.

Back to Modern Helen

- After the acetaminophen had kicked in and IV fluids were given, Helen perks up. Her neck, though, is still stiff. We end up doing a head and neck CT scan to make sure that there wasn't an abscess or pressure in the brain.

- The CT is normal. Then, we do the definitive test for meningitis, called a *lumbar puncture* or a *spinal tap*. Using a small needle, fluid from around the spinal cord is collected. The fluid was cloudy, like watery milk, rather than clear.

- Microscopic examination of that fluid shows many white blood cells, and the next day a culture of the fluid grows the bacteria pneumococcus. But by then, Helen is already starting to feel better. We had started IV antibiotics in the ED, and by the next day she is fine. After a few more days in the hospital, Helen goes home.

- Both of the Helen cases are, in fact, real cases: Modern Helen was a patient in 1995, just a few years before the introduction of a vaccine to prevent infections with the bacteria pneumococcus.

- Many people with meningitis do not do as well. Deafness and seizures are complications, as are later learning problems. Many children with meningitis also have bacteria growing in their blood, causing potentially devastating complications. We don't know for sure if Helen Keller had meningitis, but her presentation with stomach and brain congestion (that is, fever, lethargy, and vomiting) that left her blind and deaf was most likely pneumococcal meningitis.

Fever Action Plan

- Following is some practical information for parents and caretakers. This is only for otherwise well children older than two or three months of age. Babies younger than this need to be evaluated right away for fevers, and children with chronic or serious illnesses or immune problems need to have a more specific plan in place from their own doctors who know them well.

- This plan is also not appropriate for children who aren't fully vaccinated—they're at much higher risk for serious infections, and need specific instructions to help decide the best thing to do for a fever.

The Plan

If a child is really listless and not active at all, or acting really sick, call your child's doctor or head to the closest ED.

As long as the child or baby only seems a little sick, you can give a safe medication to reduce fever, typically acetaminophen or ibuprofen.

If the child perks up and feels better a half-hour later, it's unlikely that you're missing anything serious. Call your child's doctor for a routine sick appointment in a day or two for an exam.

But if your child really doesn't feel better after the fever is reduced, call your doctor right away, and consider heading in for an emergency evaluation.

Be sure to give extra fluids, and jot down when you give fever medications so you don't get the timing mixed up. You can get the exact dose and timing instructions for your child's size from his or her doctor.

As for what number constitutes a fever: The most common measure is 100.4 degrees or above, measured with a thermometer.

Suggested Reading

Offit, *Deadly Choices.*

Shelov, ed., *Caring for Your Baby and Young Child.*

Questions to Consider

1. How are sick children today different from sick children 100 years ago? What has changed?

2. When is a fever something to worry about?

Lecture 2

The Challenges of Pediatrics

At first glance, it seems that the care of children could be simpler than that of adults. Their bodies are young and strong and they don't typically have a long list of problems, the way many adults do. But think back to a few hundred years ago, when infant and child mortality was much, much higher. Through most of human history, children with even minor illnesses or congenital problems did not survive. Now we have vastly improved nutrition, sanitation, vaccinations, and technology to help prevent, diagnose, and cure many illnesses. But that means that many more medically fragile children survive, and they need our help to stay healthy and reach their maximum potential.

Meeting Jenna

- Today, we're working in a pediatric office, seeing scheduled patients. We're going to focus on one grand rounds patient today: Jenna, a 14-year-old girl with abdominal pain, who's here with her mom.

- Her mom speaks up and says Jenna's been getting bellyaches, then provides a torrent of information. You ask her to hold on, let you hear from Jenna, and chime in after to add more information. That's an important step: It's important that children feel that they can talk to their own doctor, and that their doctor will listen.

- Jenna says she usually gets belly pains maybe once a week, but for the last two or three months they're more frequent and more severe. The pain can start at any time of day, and once it starts it lasts at least a few hours. It hurts mostly in the middle of her belly, near her belly button, and feels worse if she tries to eat. She hasn't noticed that it feels better or worse when she uses the bathroom.

- What we have so far is in medical lingo called an HPI, the *history of the present illness*. Traditionally, in a medical interview, what comes next is the *review of systems*, or ROS. That's a series of questions about other symptoms or problems that might be going on.

- For Jenna with her belly pain, we'd concentrate on GI symptoms, plus constitutional symptoms like weight loss, fever, or easy fatigue that could hint at a more serious illness. Jenna denies any further symptoms from the review of systems.

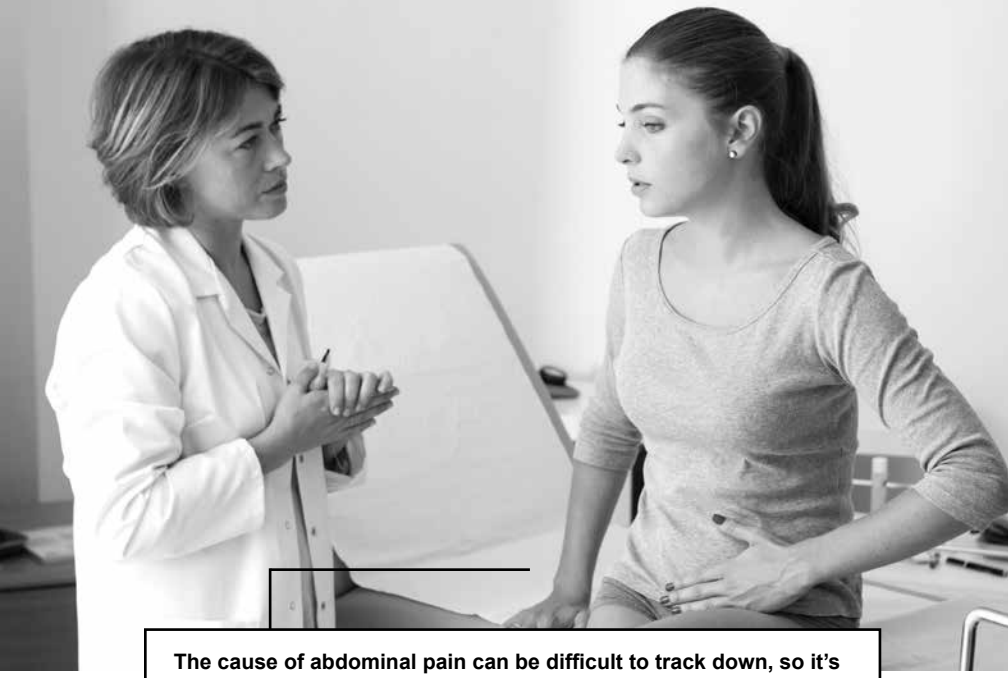
- Jenna's mom has been quiet, but you can feel a little tension in the air: She wants to speak up. You invite her to, and Jenna's mom tells you that she's been sleeping more, and seems more tired. Jenna interrupts, and she's says that's normal since she's a teenager. You ask them both to slow down and work together.

- In pediatrics, parents and caretakers have their own perspectives and expectations that have to be considered. Although it can add complexity to encounters, it really is best to listen to everyone, both to get the most information but also to make sure you're addressing what both the child and the parent are worried about.

- We ask about past medical history—skimming the chart, we don't see anything that seems relevant, but to make sure we didn't miss anything we ask about prior abdominal pains or belly problems. There are none.

- We also ask about medications. This is important: Patients will often see multiple providers, people at urgent care centers or specialists, and we don't necessarily know what medications have been prescribed.

- Jenna says she's taking birth control pills, and her mom clarifies—she had been having painful periods, so mom took her to her gynecologist, who prescribed the pills. That's a reasonable story. Jenna says the birth control pills have helped, and that this



The cause of abdominal pain can be difficult to track down, so it's important patients feel comfortable talking to their doctor about it.

abdominal pain lately feels higher up and feels different from menstrual cramps.

Food Sensitivities

- Next, we ask Jenna if there's a particular food that makes her belly pain worse. Some people are sensitive to certain foods, like people with lactose intolerance—that's difficulty with digesting the natural sugars in milk and dairy.

- Jenna says she hasn't noticed that it matters, though her mom asks about gluten. Gluten has become a food that's viewed with suspicion by many people. There are some definite, objectively provable diseases associated with eating gluten-containing food. Celiac disease is an autoimmune process that affects the gut.

- In any case, Jenna doesn't recall any specific foods as being a trigger, but one of our suggestions going forward will be for her to

keep a log—what she's eating, when the pain occurs, and what other things are going on that could either aggravate or alleviate her pain.

The Exam Continues

- In pediatrics, especially, a physical exam should always include an assessment of growth—of weight and height. Looking at Jenna's numbers from about six months ago, her height is exactly the same. That makes sense—she's physically mature, and she's probably done gaining height. But compared to six months ago, Jenna has lost 12 pounds. She had been right at average for her weight, but now she's significantly below that.

- Jenna's vital signs—her temperature, pulse, blood pressure, and respirations—are all normal. In pediatrics, the normal ranges for vital signs vary with age. Normal blood pressures are lower in children, and lower still in babies, compared to adults; and respiratory and heart rates are highest in our youngest patients.

- You find some small ulcers on Jenna's gums, what she calls canker sores, but her mom says she thinks those have been caused by her braces. Jenna's heart and lung exams are normal, and her belly exam is normal too.

- Next, we can make Jenna's problem list:

    1. Abdominal pain

    2. Weight loss

    3. Mouth sores

Diagnosing Jenna

- Belly pain in children is very common. Jenna's pain has been coming and going for a long time, so we're going to focus on recurrent or chronic belly pain, rather than acute issues.

- Sometimes, the location of a symptom can be a very helpful hint. Jenna's pain is right in the middle, over her belly button, which fits with a process within the abdomen itself.

- The most common cause of chronic abdominal pain right in the middle is what's known as *functional abdominal pain*, or *irritable bowel syndrome* (IBS). This is a very common disorder that causes chronic or recurrent abdominal pain, sometimes along with nausea, vomiting, or diarrhea. It's called *functional abdominal pain* because the tissues themselves are fine, but the functioning of the organs causes pain.

- There's another group of disorders with a similar abbreviation, IBD, which stands for *inflammatory bowel disease*. This is much less common, but medically, inflammatory bowel disease is far more likely to lead to serious complications. IBD is characterized by inflammation in the gut wall, causing pain and diarrhea. Ulcerative colitis and Crohn disease are two examples of inflammatory bowel disorders.

- We need to mention one other very common cause of abdominal pain: constipation. Jenna denied constipation, and since she's slender we would have felt excessive stool in her belly if it were present. We can't discount constipation entirely, but given what we know it doesn't seem very likely.

- Let's think next about the weight loss. In general terms, weight loss will occur when the body isn't absorbing sufficient nutrition from food to meet metabolic needs. Perhaps there isn't enough food being eaten—this could occur in cases of starvation, or in an eating disorder, or even in someone with severe dental disease who cannot eat.

- Alternatively, another explanation would be that food is getting eaten, but isn't being absorbed. This can happen in celiac disease, or cystic fibrosis, or other conditions characterized by what's called

malabsorption. If the gut itself is inflamed, it cannot do its job to absorb food.

- There's another category for weight loss, too—one where there's enough food, and good absorption, but the body's energy demands are so high that ordinary amounts of food just aren't enough. Long-distance runners and competitive swimmers can lose weight this way, as do people with hyperthyroidism or serious, longstanding illnesses like cancer. And inflammatory bowel diseases can cause weight loss by both causing malabsorption and by increasing the metabolic needs of the body by creating an inflamed gut wall.

- Jenna's age and gender put her in a high-risk category for an eating disorder. These are usually teenagers who develop a distorted body image, and refuse to eat more than a very small amount of food because they think they're unhealthy or unattractive. Other kinds of eating disorders involve binging and purging, or forcing oneself to vomit. Though they're more common in girls, boys can get eating disorders, too.

- There's no history to suggest vomiting or food restriction—in fact, her mom says that despite the abdominal pain, Jenna has been eating well. Hearing that makes you wonder: If she's eating well, why has she lost so much weight?

- There was one other item on the problem list: the canker sores, which we call *aphthous stomatitis*. Though braces or whitening toothpastes can cause them, sometimes they're associated with a form of inflammatory bowel disease called Crohn disease. Crohn disease would explain the abdominal pain, the weight loss, and the mouth sores.

- There's another challenge in practicing pediatrics: the needles and haystacks problem. Most kids are relatively healthy, but we don't want to miss the rare child who really has something wrong. In the face of all of these haystacks of kids who are fine, how do

we not miss the rare needle—the child who actually needs urgent intervention to get better?

- The most important way is to simply pay attention. In Jenna's case, the weight loss and mouth sores were the clues that said, "pay attention." Also, don't discount the power of follow-up exams. Even a child who's referred to a psychologist for stress reduction to improve irritable bowel syndrome may later develop Crohn disease.

- Since we had some red flags on Jenna's history and physical, we ask the family to head to the lab for blood tests. We need to see if the labs are suggestive of either celiac disease or Crohn disease.

- Jenna's celiac serologies are negative, but she has a lot of abnormalities on her blood tests. She's anemic, with low iron (probably from blood loss in her gut), and her albumin is low, suggesting that she's been losing protein through her gut wall, too. We refer Jenna to a GI specialist, who performs an endoscopy. Jenna's biopsies are diagnostic of Crohn disease.

- Though it's a chronic illness without a cure, most children with Crohn disease do very well with therapy. Oral and sometimes IV anti-inflammatory drugs and immune modulators can dramatically reduce symptoms and extend healthy lives.

- It's also crucial to monitor nutrition closely, to avoid deficiencies and provide adequate calories for growth. Sometimes, surgery will be needed to remove sections of bowel that are most affected, but unfortunately this is rarely curative—Crohn disease can come back, later, in a different part of the gut.

- It's also crucially important in Crohn and other chronic diseases of children to get both the child and family actively involved in care. Medical regimens are complex, and have to be individualized. We have to balance symptom control, lifestyle, future health, and the

child and family's own perspectives on how they feel about the disease, the drugs, and the side effects.

Suggested Reading

Ali, *Crohn's and Colitis for Dummies.*

Toner, et al., *Cognitive-Behavioral Treatment of Irritable Bowel Syndrome.*

Questions to Consider

1. How can parents tell if abdominal pain is likely caused by something serious?

2. Are there advantages for children to see the same doctor, year after year?

Lecture 3

Struggling with Ear Pain

Here's a common scenario: Your 18-month-old is acting fussy, maybe with a little fever. After a few days, you bring him to his doctor, who peeks in his ear. The doctor says it's an ear infection. One course of antibiotics later, and the child is back to his happy self. Simple, right? But it turns out that this quick scenario hides a lot of important decisions. In this lecture, we're going to concentrate on one of the most common medical problems diagnosed by pediatricians, family medicine doctors, emergency physicians, and anyone else who provides medical care for kids: the ear infection.

Meeting May

- Our first patient is May; she's seven months old. Her mom and dad have brought her in because she's had cold symptoms for a few days, and last night she woke up several times, screaming. She's had no fever, just a runny nose and some coughing. Her appetite and energy level have been good. May attends day care five days a week, and her mom says several other babies have been out this week with colds. May is up to date on all of her routine immunizations.

- To understand why that information is important, we'll need a brief ear anatomy lesson, and a few words about viruses and bacteria. When we use an otoscope, we're looking into the ear canal. Way in the back, and the end of the canal, is the tympanic membrane, or eardrum. That separates the outer from the middle ear. Water splashed into the outer ear or ear canal can't get past that eardrum, and cannot cause any problems in the deeper part of the ear.

- Past the tympanic membrane is the middle ear, a thimble-sized cavity that's ordinarily filled with air. Within the middle ear are the ossicles, a chain of three very small bones that transmit sound waves from the eardrum to the oval window, a smaller membrane that then transmits sounds to the cochlea of the inner ear.

- There is also a small opening at the bottom of the middle ear that connects to the Eustachian tube, which then connects to the inside of the nose. Any fluid that accumulates in the middle ear is supposed to drain out through the Eustachian tube into the nose. If there's fluid in the middle ear, it dampens the ossicles' vibrations, making it difficult to hear.

- When someone gets what's technically called an *upper respiratory infection*, or a common cold, the lining of the nose becomes inflamed and makes extra mucus. But that mucus also can plug up the Eustachian tube, preventing drainage. Potentially, the nasal mucus can even track backwards, traveling up the Eustachian tube to fill up the middle ear.

An otoscope in use

- Almost all ear infections start this way: with an upper respiratory infection, creating mucus in the nose, which traps bacteria. It's that bacterial infection that leads to what we've been calling an ear infection. The real, medical term for an ear infection is *otitis media*. *Otitis* means inflammation of the ear; *media* refers to the middle ear. So otitis media is inflammation of the middle ear.

- Back to May: Her temperament and vital signs are normal. She has a crusty, yellow discharge from her nose. She's breathing easily, and listening to her lungs and heart, everything seems normal.

- When you look inside her ears with an otoscope, it's difficult to see all the way to the back—there's a lot of wax there. After a gentle clean-out with a tool called a curette, you can get a good look. Both of May's eardrums look red, bulging, and distorted.

- The eardrum itself is a thin, translucent membrane. If there's fluid behind it, either partially or completely filling the middle ear, the drum can look dull. If the fluid is infected, that infection builds up pressure, and the eardrum typically bulges out at you and looks pink or red. That's what causes the pain of otitis media—the pressure and inflammation of the infected middle ear fluid.

May's Treatment

- Treatment of otitis media should always start with pain relief—these things hurt. A simple heating pad can help some; the kind you heat in the microwave, not an electric one, is preferable so we're sure it won't get too hot. You can also use eardrops to try to numb the eardrum, though those are only partially effective: Drops into the ear canal can't get into the middle ear space.

- The most effective way to reduce the pain caused by a middle ear infection is with an oral analgesic, like acetaminophen or ibuprofen. The best way to use those is around the clock, regularly, for a few days. We'll also give the family a prescription for an antibiotic.

Two Weeks Later

- The family has returned with May for an ear recheck visit. That's an important step, because May isn't talking yet—she cannot tell us if her ears still hurt, or if there are any changes in her hearing. When you take a look, there is still fluid there, behind the drums. It's not red or bulging—just clear or a little milky white.

- This is a common problem. We called the ear infection we saw two weeks ago otitis media, though more formally it should be called *acute otitis media*, or AOM. That's to distinguish it from what we're seeing today, which is *serous otitis media*, or SOM. *Serous* means uninfected clear fluid.

- Serous otitis media can follow after a successfully treated acute otitis media—the infection is gone, but the fluid hasn't yet drained, perhaps because there's still congestion and swelling in the nose. Or, serous otitis media can happen during a cold virus.

- The correct thing to do about serous otitis media is sometimes the hardest thing for doctors to do. We suggest doing nothing, or just waiting. We'll recheck the ear again in a few months, and unless an infection develops with redness and symptoms, we'll wait for the residual fluid to clear on its own.

- If the fluid lasts longer than three months, we may refer May for a hearing test. If she has persistent fluid for months and a problem with hearing, only then would it be time to consider surgery to place tubes to drain the fluid.

Ezra's Face

- We've got another patient waiting: Ezra, a 10-year-old boy. When he woke up this morning, his parents tell you, his face looked like the right side was drooping. When you ask him to shut his eyes, tight, his right eye closes only a little, and he cannot lift his right eyebrow or wrinkle up the right side of his forehead. His right eardrum is dull, pink, and bulging.

- Ezra has a facial nerve paralysis—the nerve to the muscles on the right side of his face isn't functioning. It's a rare, but well-known, complication of his right-sided ear infection. The facial nerve travels close to the middle ear space, and sometimes the infection can spread to put pressure on the nerve.

- Ezra's care is aggressive: Admission to the hospital for IV antibiotics, and a CT scan to confirm that there was no other mass or other cause of the facial nerve paralysis. Insertion of a small tube in his eardrum allows better drainage. His infection clears quickly, though it will take two months for the complete return of facial nerve functioning.

Tai Lee

- Let's meet another patient, Tai Lee. She's 15 months old, and she presented with a cold that lasted several days, and then fussiness. But Tai Lee has already had five previous ear infections. Her parents want to know if there's any way to prevent this and what to do next.

- We know otitis media usually begins with a cold, so anything that parents can do to prevent colds will prevent ear infections. Stopping group care will reduce the frequency of colds, but that's not practical for many families. Vaccines can protect against at least some ear infections, so we'll review the record and make sure Tai Lee is up to date.

- Other risk factors include secondhand smoke exposure; bottle-feeding if the bottle is propped up vertically while the baby lies flat; gastroesophageal reflux (though studies haven't been entirely consistent about that); allergies; and altered facial anatomy.

- Back to Tai Lee, and her exam: We see that both of her ear canals are filled with yellow fluid, and we cannot see her eardrums at all. This is pus, and it's almost certainly from burst eardrums. Tai Lee had infections behind the thin membranes of her eardrums, and that pressure built up enough to cause the drums to break.

- That's not necessarily a bad thing: A burst eardrum allows the infected fluid to escape, which releases pressure and relieves pain. Plus, the pressure doesn't build in toward the brain. And an eardrum that bursts once or even a few times is almost certainly going to heal and not affect hearing in the long run.

- For today, we'll clear out some of the infected mucus from Tai Lee's ear canals with a soft swab. We'll also prescribe antibiotic eardrops (the eardrums are broken, so drops put into her ear canals can go right through to her middle ear cavities).

- We'll start talking with Tai Lee's parents about an ENT (ear, nose, and throat specialist) referral. It's time to consider the placement of ear tubes, which create a semi-permanent connection between the outer and middle ears. Though there are some drawbacks to the procedure to consider, it will allow any fluid that accumulates in the middle ear to drain outwards, into the ear canal, even if the Eustachian tube is blocked.

More Patients

- Let's meet a few more patients. John's a three-year-old who had a cold, then woke up last night complaining of ear pain. On his exam he looks good—he says it doesn't hurt any more—and his right eardrum looks just a little pink.

- John has a mild ear infection, and at his age it's very reasonable to talk about the option of waiting to start antibiotics. Most ear infections do get better, and to ease his parents' minds, we can even provide what's called a *backup antibiotic prescription* if his pain persists or worsens.

- Now, let's change the scenario a little. John's still three, but he's really complaining of pain, he's vomiting, and he has a red and bulging eardrum. In this scenario, we'd want to start antibiotics, perhaps given after a dose of a medication to relieve nausea and vomiting so he's sure to keep it down.

- Alternatively, we could offer the antibiotic in an injection. We use injected antibiotics if there's persistent vomiting, or if ordinary oral antibiotics have failed to clear an infection.

- One more patient: Patrick, 11 years old and complaining of ear pain. His eardrum is absolutely normal. It turns out other things can cause ear pain, too—sometimes pain referred from elsewhere, like the jaw or a tooth. Or, sometimes, it's the ear canal, the part right inside the opening, that's red and inflamed.

- We call that *otitis externa*, meaning external otitis, or inflammation of the canal. This can be caused by trapped water from swimming—that's why it's sometimes called *swimmer's ear*—or from irritation, or trauma from, say, too-aggressive use of cotton swabs in the ear. Otitis externa can be treated with eardrops.

Suggested Reading

Benaroch, *Solving Health and Behavioral Problems from Birth Through Preschool.*

Hamlin, *More than Hot.*

Questions to Consider

1. Why are ear infections so common in children?

2. Do all infections need to be treated with antibiotics?

Lecture 4

The Allergic March

One thing that makes the practice of pediatrics unique is the privilege of traveling along with families as children grow and develop. But along with watching children grow and change, we'll sometimes see how health concerns develop as a child grows. Sometimes, one health problem that begins early can influence the development of problems later. Hopefully, if we can intervene early we can prevent later problems. That's the goal of pediatrics—to keep our patients healthy by preventing disease. That's not always possible, but that's our goal.

Liam's Rash

- Let's meet Liam. He's a three-month-old boy with a chief complaint of "rash on face." The *chief complaint* is the answer to the question, "Why did you come in today?" or "What can I do for you?" It is usually stated in the patient's own words, but in pediatrics, some of our patients aren't talking yet.

- Three-month-old Liam may be very smart, but in this case we're going to have to use a chief complaint from his mom instead of the patient. Liam has been in good health, and there have been no prior medical concerns. He's exclusively breastfed, and he's up to date on his immunizations. He has an older brother, Robert, who's now five years old. The brother has a long history of many health visits for eczema, food allergies, and asthma.

- Let's go ahead to Liam's physical exam. He's happy and smiling, sitting propped up in mom's lap. On both of his cheeks, though, is a dry, red, scaly-looking rash. The rest of his exam is normal.

- The physical exam is diagnostic here: Liam has *eczema*, a very common rash that often starts in infancy. It tends to be a very itchy rash. Eczema is sometimes called "the itch that rashes"—first comes itching, which causes scratching, which leads to skin breakdown and a rash.

- Liam's mom says, "Yeah, I knew that's what it was—Robert had that too." That's another unique feature of pediatrics: We don't just hear about a family history of disease, we sometimes see it unfold in siblings.

- Liam's mom wants to know what to do about the eczema. The treatment of eczema should always start with good skin care. One of the fundamental problems in eczema is a breakdown of the skin's natural barrier function. A topical moisturizer can do a great job restoring that barrier and keeping the skin healthy.

- You also talk with her about using a topical anti-inflammatory medication if moisturizers alone don't work. For starters, over-the-counter hydrocortisone ointment is the mainstay medication, though there are many more potent products available by prescription if necessary. These medications are almost all in a class called *steroids*, which are modeled after our body's own built-in anti-inflammatory hormones.

Liam at Two

- We're going to fast-forward a few years. Liam is two now, and his mom has brought him in because of a worsening of his rash. His eczema had spread from his cheeks to his extremities, and over the last year you've prescribed a stronger topical steroid that his mom has used intermittently. Now, his eczema is worse than ever, and it's time to think about some new approaches.

- On the exam, you notice Liam isn't happy. He's itching, and you can see scratch marks on his arms and legs, over the eczema. What started as fairly mild eczema has become much worse.

- Since eczema is in part related to damage to the skin, it's important that the family continue a good moisturizing routine. Regarding baths: They should be gentle, using lukewarm rather than hot water; children shouldn't soak in soapy water. Let them play in plain water, then add a little soap, do a gentle scrub, rinse, get them out, and use a moisturizer afterwards.

- Often, the damaged skin associated with eczema allows bacteria, especially staph, to proliferate, and that can lead to more inflammation and more skin damage, perpetuating the cycle. Overuse of antibiotics to fight this isn't a good idea. In children with moderate to severe eczema, you should monitor for infection, and consider using weekly baths with diluted bleach to reduce bacterial carriage.

- A half-cup or so of ordinary bleach in a whole bathtub of water makes a safe, low-concentration bath with less chlorine than a typical swimming pool. We'll get Liam started on a diluted bleach bath routine, and do a brief seven-day course of oral antibiotics this one time, to help get things under control.

- It's also important to try to control the itching. Itching is miserable and leads to scratching, which worsens the skin breakdown. A cool wet compress can help a lot, sometimes along with an oral antihistamine.

- We'll also adjust Liam's topical anti-inflammatory medication regimen, stepping up to a stronger topical for a week or so, and then stepping back down the ladder to less potent products as he improves. This is a case where regular follow-up with a pediatrician or dermatologist is essential, as is good parent education.

- There's one other aspect of eczema care to bring up: Kids with eczema have a much higher chance of having food allergies, and at least some eczema does seem to worsen when certain foods are ingested. The most common allergic trigger is probably eggs or cow's milk.

Liam's Return: Anaphylaxis

- We see Liam again sooner than expected—a few weeks later, Liam is here for follow-up of a different nature. He had been rushed to the emergency department two days ago after eating peanuts. Very soon after he ate them, he developed big red blotches over his entire body, and started to cough.

- At the hospital, he was given epinephrine and IV fluids. They kept him overnight for observation, and sent him home the next day. Today, in your office, he seems to be doing well. His eczema, actually, looks a whole lot better now. His mom says, "I just knew he shouldn't have had those peanuts!"

- Most of today's encounter is about talking and teaching, and making sure the family knows what to do. What happened to Liam was a severe and potentially life-threatening allergic reaction, called *anaphylaxis*. That's a serious reaction that occurs quickly after an exposure, often to a food or something like a bee sting.

- You explain that it's crucial that Liam avoid peanuts, and that rescue medication is on hand in case of an accidental ingestion and reaction. This medicine is called *epinephrine*, and it comes in a device that can automatically inject it into the body.

- Liam's mom wants to know: Does Liam have to be allergy tested for peanuts? In a way, the answer is no. He already had the test—he ate the peanuts, and had a very serious reaction, and so we know he is allergic. Still, there is a role for testing. It is a good idea to consider testing for what are called cross-reactive foods—in this case tree nuts, which Liam might also be allergic to.

- When food allergy and eczema go together, the eczema usually comes first. Recent research has concentrated on a specific skin protein, filaggrin, which may be the key to unlocking the connection. Many children with eczema have a genetic defect in their filaggrin, leading to skin that's essentially leaky, allowing foreign proteins to be exposed to tissues underneath the skin. This can lead to allergic sensitization, which may then lead to food allergy.

Preventing Food Allergies

- For many years, we advised parents to avoid giving their children the foods that commonly caused allergies until they were older. It turns out that studies have shown, overall, that the opposite approach is better. Earlier introduction of these foods may actually prevent allergic sensitization.

- Current guidelines suggest introducing complementary foods—solids—to babies starting at four to six months of age, without excluding or delaying any of them. Of course, parents still have to be mindful of choking—a small smear of peanut butter is fine, but a whole peanut wouldn't be good for a baby.

Back to Liam

- Let's fast forward, again, Liam is now six years old. He's had no further peanut exposures, and now proudly wears a medical alert bracelet, which says "no peanuts." He's here today with a new problem, a chief complaint that he states himself: "My nose always itches and mom says I have to stop rubbing it."

- Liam has what's commonly known as hay fever, or allergic rhinitis. The allergies that trigger this are usually environmental ones,

pollens and dust and mold. Allergic rhinitis is far more common in children who have a history of eczema and food allergies.

- Liam is undergoing something called the *allergic march*. He has marched from eczema to food allergy to allergic rhinitis.

- The treatment of allergic rhinitis starts with avoiding triggers, though that's not always easy. Many environmental triggers are found all over, indoors and out, and many people have multiple triggers. Still, some specific avoidance can help—for instance, if dust is a trigger, try to minimize stuffed animals and other dust collectors in bedrooms.

- For children, the most effective relief comes from allergy medication. One of the oldest of these is still in wide use: diphenhydramine, also called Benadryl. It's an antihistamine—it blocks the action of the chemical histamine, which is at the center of most allergic reactions. Though Benadryl works well, it's sedating. There are many newer antihistamines that are both less sedating and more long lasting, making them easier to use.

- Another big category of allergy medications are topical nose sprays—which are, in many cases, the same topical steroids that are used in the treatment of eczema.

Liam's March: Asthma

- Two more years pass, and Liam returns with another concern: He's coughing, a lot, especially at night, and especially after he runs and plays outside. His mom, who's been through this before, doesn't even wait for you to make the diagnoses. "Don't tell me," she says, "he's got asthma now, too."

- When you listen to his chest with your stethoscope, you hear a wheezing sound, which is indicative of asthma: a reversible airway obstruction, from tightening of the airways in the chest after certain triggers. The main symptom of asthma is cough.

- Asthma is the last disease of the allergic march: eczema to food allergy to allergic rhinitis to asthma. Not all children who have some of these illnesses will develop all of them, but all of them are risk factors for each other.

- The treatment of asthma starts with avoiding the triggers, if possible. But we don't want to keep kids indoors, avoiding exercise—that's not healthy, either. In the long run, it's especially important for kids with asthma to keep exercising, to keep their lungs and hearts and bodies fit and in good shape.

- Most medications used to treat asthma are inhaled medicines that go straight into the lungs, coating the lining of the lungs where the inflammation is taking place. Many of the medicines for long-term control are steroids—the exact same steroids used on the skin to treat eczema, and on the lining of the nose with sprays to treat allergic rhinitis.

- People with asthma also depend on a quick-relief rescue inhaler, using a different kind of medicine that's essentially a muscle relaxer for the muscles around the breathing tubes. They work quickly and well, but they don't actually address the underlying inflammation. If used too frequently, they stop working.

Suggested Reading

American Academy of Allergy Asthma & Immunology, *Conditions and Treatments*. https://www.aaaai.org/conditions-and-treatments.aspx.

Velasquez-Manoff, *An Epidemic of Absence.*

Questions to Consider

1. Why are allergies becoming more common?

2. What's the best role for allergy testing?

Lecture 5

Problems with Growth

In pediatrics, our patients are, in many ways, moving targets. They're not supposed to stay the same, year after year. They grow both physically and mentally, learning new skills and getting taller and heavier. All of that growing takes a lot of metabolic energy, which parents of especially teenagers know very well. It's fundamental to the health of children that they grow well. If they're not growing as expected, something has gone wrong. This lecture is about a patient with that specific problem.

Melissa's Height

- We've got a new patient in our practice today: Melissa. She goes by Mel; she's 12 years old, and her chief complaint is: "My mom thinks I'm short." That says a lot: The way she worded it marks it as her mom's concern.

- There's really no past medical history, you're told—she doesn't have any related ER visits and isn't seeing any specialists. What about reviewing past medical records? That's easier said than done. In this case, Mel's family forgot to bring them, which happens a lot. But even more vexing is when parents do bring the records, but they're too long or illegible to be useful.

- A lot of us use computerized records now, which is great for some things, like recording a detailed note. But that same level of detail makes it difficult for a new doctor to review records efficiently. An ideal solution is a combination of a problem list, a list of current medications and drug allergies, a complete list of vaccines, and a set of growth charts.

- With Mel's chief complaint about growth, old charts would have been useful, but lacking them, we'll ask Mel about what she thinks about her growth. She says she's always been the shortest in class, and since she hasn't started puberty yet all of the other girls are just way taller than she is now. Her mom agrees.

- We measure Mel, and find she's quite short at 54 inches. That's about the second percentile for height for a 12-year-old girl. The second percentile means, essentially, that if we were to find 100 girls of Mel's exact age and line them up by height, she would be number two, with 98 taller girls and 1 shorter.

- Her weight is also at the second percentile, at 66 pounds, and her BMI, the body mass index, is at about the 10th percentile. Mel is short, and somewhat slender. Her vital signs are all normal.

- Mel is short, but is she really shorter than expected? The next thing we need to do is to compare her height and expected adult height to what's called her *mid-parental height*.

- Mel's mom, we learn, is 5'3" tall, and her dad is 5'8" tall. To calculate Mel's expected adult height from these numbers, we first subtract five inches from her father's height. That's because, on average, women are five inches shorter than men. Her dad corrects to 5'3", and averaging that with mom's adult height of 5'3", we expect Mel to grow to be 5'3".

- We said Mel was at the second percentile for height. If we track that upward, assuming she stays at the second percentile, she'll be 59 inches tall as an adult, or 4'11". That doesn't compare very well with that adult predicted height of 5'3". Under most circumstances, kids grow up to be within an inch or two of that predicted mid parental height. We're starting to share Mel's mom's concerns.

Potential Diagnoses

- Let's think about what kinds of things might be going on before we move on to our physical exam. Kids who don't get adequate nutrition won't grow well. If there's not enough food, an eating disorder, or GI problems, there may not enough growth. But Mel has a good appetite, no evidence of eating disorders, and no evidence of GI problems.

- Beyond the gut and nutrition, another group of conditions that affects growth relates to the endocrine system, the chemical hormones that regulate many of the body's functions.

    - Overactive or underactive thyroid functioning can slow growth in children. Mel didn't report other symptoms of thyroid dysfunction, like feeling cold or hot or having diarrhea or constipation or changes in her hair or skin, but let's keep that possibility in mind.

    - Children's growth can also be slowed if there's insufficient growth hormone.

- But, at 12, the most important endocrine influences we need to think about concern puberty. If children enter puberty early, they'll shoot up in height, and they'll be taller than their peers for a year or two. But, an early puberty means that the pubertal growth spurt will stop early, too—so these same kids who seemed so tall end up stopping their growth when they're young, and they end up short.

- There are genetic conditions that affect adult height, too, but these are more rare. The skeletal dysplasias—these are also known as conditions that cause dwarfism—are rare, and long before age 12 we'd notice changes in the proportions of a child's bones, leading to that diagnosis.

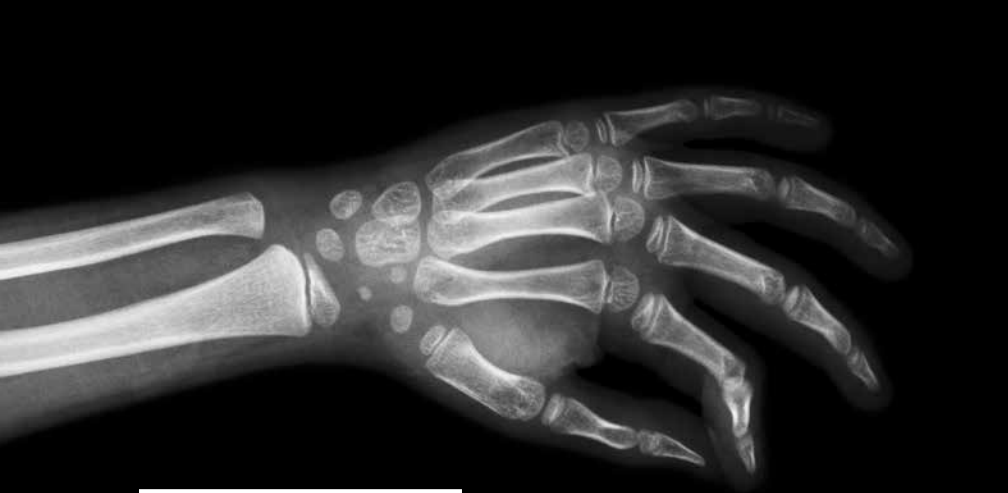
The Physical Exam

- Mel looks comfortable and well, with normal vital signs. She doesn't have any other physical findings that suggest thyroid disease, either, like a goiter or unusually fast or sluggish reflexes. Her heart, lung, and belly exams are completely normal, and she appears to be entirely healthy and well proportioned. She has not begun any pubertal development—she has no breast development at all.

- That's important to check, because breast development is the first reliable sign of puberty in girls. With no breast development, we know Mel has not started puberty.

- We ask her mom if she started puberty early or late. Mom says she not exactly sure when it started, but she does remember she got her first period in 8th grade, which seemed late to her. Perhaps Mel will follow that pattern, and is just destined to be a late bloomer, too.

- We also ask about her dad's history—he's not here today, but the timing of his puberty counts, too. Unfortunately, men often don't recall when they hit puberty. Mel's mom says she has no idea when he hit puberty, and she doubts he would have any idea either.



An X-ray of a child's wrist

- In summary, Mel is an otherwise healthy 12-year-old girl who is slender and short. She may well end up being a late bloomer, which would predict maybe we're underestimating her adult height. There are no clues on the history and physical exam that point to any ominous or serious medical conditions.

- An X-ray called a *bone age*, which focuses on the bones of the left wrist, can help get a better estimate of Mel's adult age. A bone age tells you how old Mel's bones look—do they look like those of a younger person, maybe a 9-year-old, who has many years to grow? Or more like a 15-year-old, who's nearing the end of her growth?

- A few days later, Mel's bone age returns at 10.5 years—a little delayed, predicting that she'll be a late bloomer, and predicting an adult height of 5'1". Still, short, though taller than our earlier estimate of 4'11". We still need to keep an eye on this girl.

Mel's Recheck

- Four months later, Mel comes in for her recheck appointment. She looks a little more discouraged, and is acting quieter today. You

ask Mel about other things, and she says she's not sleeping well, she keeps waking up, and she feels tired a lot.

- Let's see what happened with her growth numbers. In the last four months, her height increased by about a half-inch—that's a little less than expected for this age, and certainly not a gain that looks like she's going to start puberty soon. Far more concerning is her weight, which has dropped from 66 to 60 pounds.

- After a few questions, she reveals she's also thirsty all the time and urinating frequently. Now we have a new clue: Mel has been losing weight since the last visit, and she's been thirsty all the time, and urinating frequently. The diagnosis this suggests is diabetes, or more specifically, diabetes mellitus. *Diabetes* is derived from the Greek word for "siphon," while *mellitus* comes from the Greek word for "sweet," referring to excess sugar in the blood and urine. Mel probably has type 1 (juvenile) diabetes.

- You have Mel give a urine sample. It tests positive for glucose—that's sugar in the urine, and that only happens when the blood sugar is very high. A quick fingerstick blood sugar test is then done. A normal non-fasting blood sugar should be less than 140, and Mel's is 350.

- Mel and her mom have heard about diabetes, and when you bring that up they look scared. You don't want to be a torrent of information right now, but it's your job to get things started. You tell Mel and her mom that there will be more tests to confirm the diagnosis, but there are great treatments for diabetes, and that overall she'll be fine.

Diabetes Basics

- Diabetes is a simple enough disease to understand, though the ramifications and management strategies can be very complex. Sugar is an essential nutrient and an essential fuel source for the body's cells, and the amount of sugar—that is, glucose, the kind of

sugar that circulates in our blood—is tightly regulated by a number of mechanisms.

- The hormone insulin, secreted by the pancreas, plays a key role. Insulin serves to push glucose into the body's cells, lowering circulating blood glucose. In diabetes, blood glucose concentrations run too high because of insufficient insulin activity.

- There are two kinds of diabetes mellitus. Adults, especially obese adults, are prone to what is now called type 2 diabetes, where body tissues become resistant to the effects of insulin. The insulin is there, but it doesn't work. In type 1 diabetes, there is no insulin—the cells in the pancreas that are supposed to make the insulin die off, so there's no insulin at all.

- Diabetes in children, in the short run, causes excessive sugar in the urine—a lot of sugar, and enough to rob the body of needed calories, causing weight loss. Children will make a lot of urine, as well, so they'll both urinate frequently and seem to be hungry all the time, to make up for the lost calories. Sometimes, children with diabetes can initially present in life-threatening crisis brought about by dehydration called *diabetic ketoacidosis*.

- Treatment will be lifelong. Mel will need to follow a healthy diet without a lot of simple carbs, and will have to monitor her blood sugar and give herself insulin by injection several times a day.

- That's not fun, but we know that with good therapy and good control of the blood sugar, she can lead a long, healthy life free of the complications of diabetes. And that's the real problem—those long-term complications, like heart and kidney disease, blindness, strokes, and early death. Mel's mom wanted to know if Mel was too short; what we want to ensure is that she'll live a long and healthy life.

Suggested Reading

American Diabetes Association, *American Diabetes Association Complete Guide to Diabetes.*

Kaufman, *Medical Management of Type 1 Diabetes.*

Questions to Consider

1. How do you judge if a child's height is less than it should be?

2. What's the difference between familial short stature and short stature caused by a medical problem?

Lecture 6

Childhood Obesity

In this lecture, we're going to meet an obese patient who initially comes in because of headaches. We'll figure out the source of the headaches, and then move on to a discussion of childhood obesity. The lecture covers causes of obesity, complications that can arise from it, and ways to head off obesity before it starts or combat it once it's there. As we'll see, obesity is a complicated problem, and dealing with it takes help from the patient, their family, and their physician.

Meeting Chaz

- Chaz is a 16-year-old young man who has come into our pediatric clinic with a chief complaint of "headache." The next part of the encounter is learning more of the history of present illness.

- Chaz says he's been getting headaches for a year or more, but they've gotten worse lately, and they're happening almost every day now. He's been late to school many days.

- We ask more questions about severity, timing, and how the headaches affect his life. He says they're getting worse, though not dramatically so—just more frequent. They started, he thinks, a few summers ago, and almost always happen in the morning.

- Over-the-counter pain medicines like acetaminophen do make the pain better. There've been no fevers, no sinus congestion, no allergy symptoms, and no vomiting.

Background on Headaches

- Before we proceed, a few words about headaches:
  - They're very common. Most headaches, in children and adults, are not caused by anything that's going to lead to serious problems.
  - That doesn't mean the headaches themselves aren't a problem—headaches can cause a lot of misery.
  - Most headaches are called *primary headaches*. These include migraine and tension headaches.
  - *Secondary headaches* have a specific medical cause that needs to be identified and treated. These are more worrisome, as they could indicate something like a tumor.
- To figure out whether a headache is primary or secondary, the clues are almost always found in the history and the physical examination.
- The most important single clue is the pattern of the headaches. Headaches that are intermittent are very unlikely to be of any urgent medical cause. Headaches that are constant—especially headaches that worsen from day to day—and headaches accompanied by abnormalities on the physical exam are the headaches we never want to miss.

Back to Chaz

- So far, Chaz's history doesn't neatly fit into either being a primary or secondary headache. Let's see what clues we find on the physical examination.
- Chaz looks comfortable and well. His weight is 260 pounds, and his height 6'2". The measured blood pressure is 128/84, his pulse is 88, and his respiratory rate is 16 breaths per minute. That blood pressure is mildly elevated, but that's not a cause of headaches.

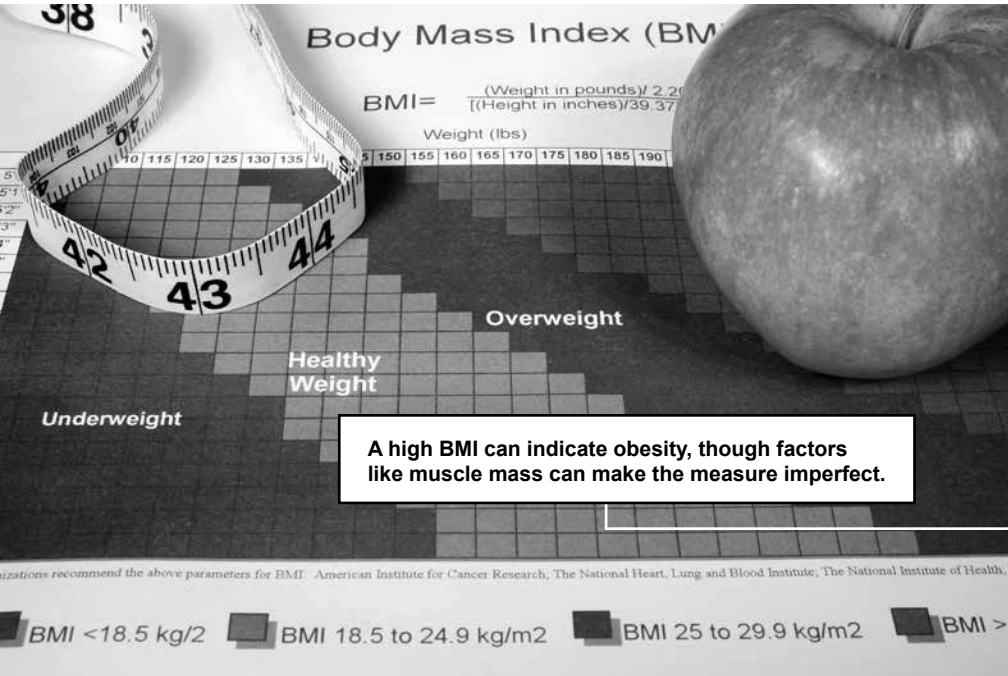
- The HEENT portion—that's head, ears, eyes, nose, and mouth—of his exam is normal. We also do a detailed neurologic exam, looking for deficits or problems with strength or reflexes or coordination—again, we want to make sure that there's no hint of a problem in the brain—and all of that is normal.

Chaz's Weight

- It's our job to do the best for our patients, which means we've got to think about Chaz's weight. Is it somehow contributing to these headaches he's been having?

- Although it's imperfect, most research and clinical measurements of obesity rely on what's called the *body mass index*, or BMI. This is calculated as the weight divided by the height squared, in metric units. The BMI is useful because it incorporates both weight and height.

- But it doesn't differentiate lean body mass, or muscle, from fat or adipose tissue. Someone who spends a lot of time at the gym,



with solid muscles and very little body fat, may actually have a high BMI in the obese range—though they're not overweight and have excellent health. Still, the BMI is simple, and we're used to it, and it can easily be tracked over time.

- In adults, a BMI from 18 to 25 is considered a healthy weight; from 25 to 30 is overweight, and above 30, obese. Chaz's, who's 16, has a calculated BMI of 33—at that age, we can use the adult norms. He is obese.

Obesity Problems

- Many of obesity's complications, or medical problems, coexist under the *metabolic syndrome*, which includes high blood pressure, insulin resistance, and abnormal cholesterol and other lipids. These can contribute to diabetes, strokes, and heart disease.

- Another common complication of obesity is non-alcoholic fatty liver disease, or NAFL. This is fatty accumulation in the liver that can lead to liver failure. But NAFL doesn't particularly cause headaches as a main symptom.

- There are many orthopedic complications of obesity, including problems with the feet and hips that cause pain and interfere with exercise. This can make it harder to get someone active. And many people who are overweight have decreased exercise tolerance to begin with.

- Many teens and adults with obesity also suffer from psychological problems, including depression, anxiety, bullying, and social isolation. Those can cause headaches. But Chaz says he has not been feeling down or hopeless, and he's enjoying spending time with friends—those make it unlikely that he has major depression.

- There's a specific obesity complication that can definitely cause headaches—but we've already ruled that out on our physical exam. People with obesity can develop what's called *pseudotumor cerebri*. In a pseudotumor, there is increased pressure within the

cranium, but it's not caused by a physical tumor. The normal flow of fluid around the brain is interrupted, and the fluid pressure goes up. During the physical exam, we looked at the back of the eyes with our ophthalmoscope, and saw no changes to indicate pressure back there—so pseudotumor is very unlikely.

- Obesity can also interfere with sleep. One of the mechanisms of poor sleep in obesity is obstructive sleep apnea, where the airway closes off during sleep. The patient will wake up, at least partially, then gasp and breathe again. This can happen many times an hour, and each time it happens it interferes with normal, restful sleep.

- You ask Chaz: "Do you snore, or have trouble sleeping well at night?" His mom interrupts and says he snores loud enough to hear him through the wall. Chaz says he knows he wakes up sometimes, with a feeling that he couldn't catch his breath—and he doesn't feel rested in the morning, sometimes falling asleep in school.

- It sounds like Chaz has obstructive sleep apnea, which can cause headaches just like these. In the short run, there are just a couple of things Chaz can try that might help, some. Trying to sleep on his side may result in less apnea than sleeping on his back—Chaz says he already figured that out, that if he ends up on his back, he wakes up.

- An old-fashioned trick is sewing a tennis ball into the back of the shirts he sleeps in, making it uncomfortable to sleep on the back. There's also some evidence that steroid nose sprays can help at least some people with sleep apnea and snoring, by shrinking the nasal and adenoid tissues.

- We'd also like to schedule Chaz for a polysomnogram, also called a *sleep study*, to really see what's going on at night. This kind of a study can show if there are periods of obstructive apnea.

- More definitive therapy for obstructive sleep apnea is more difficult and invasive. In younger children, and in many teens like Chaz,

surgical removal of the tonsils and adenoids helps. There's also a non-surgical option, using a tight-fitting mask at night to provide what's called *continuous positive airway pressure*, or CPAP.

- We make arrangements for the sleep study, and for Chaz to follow up with an ENT specialist after the study is done; we also ask Chaz to make a follow-up appointment with us in a few weeks, to see if some of our simpler ideas work. We'll also need to follow up on his mild hypertension (which can improve if he loses weight), and consider a laboratory evaluation for insulin resistance, to check his lipid profile, and to rule out fatty liver disease.

The Bigger Picture

- We still need to address the bigger picture here, which is obesity. We'd like to suggest some ways for Chaz to lose weight, but at the same time, we don't want to drive Chaz away.

- One good way to address topics like obesity is through a process called *motivational interviewing*. It's a way of thinking about problems that starts with the patient.

- We start by saying to Chaz that sleep apnea is a common problem in people who are overweight. Then we ask if he has any concerns about his weight. If he says no, it's going to be difficult to get him to make any changes—you'd concentrate first on perhaps outlining the problem, or why you see it as a problem, even if Chaz does not.

- Today, Chaz says, "Yeah, of course, I know I weigh too much." The next step is to reflect back and empathize: "I hear you saying you're concerned about this, too."

- Then you can ask if Chaz thinks now is a good time to think about making some changes to make some progress on the problem. Chaz says he was thinking he might be able to drink less soda. We reflect that back, and agree that that would be a positive change, and try to nail down some details. It's not realistic to expect all

soda to stop, but maybe come up with some numbers—perhaps two a week.

- It might seem like a slow process, this motivational interviewing, but working it into a conversation about health habits isn't really difficult, and doesn't have to take a lot of time. The idea is to hopefully come up with just a small number of definite changes that the patient thinks he can do.

Causes of Obesity

- Though it can start with a few simple ideas, the management of obesity in children is difficult. There are family and genetic influences—the biggest risk factor for childhood obesity is parental obesity, though it's not entirely clear whether this is mediated by genetics or by shared environment, eating, and activity styles. It is nearly impossible to help a child fight obesity on their own—you have to include the family, and sometimes that's difficult, to get all parties involved and motivated to change.

- Though parents often ask about medical causes of obesity, these are really rare. The main cause of gaining weight, stated simply, is a condition of energy imbalance. If people eat more food (calories) than they need to meet their own energy requirements, the extra food energy will be stored, mainly as fat.

- But it's more complicated than that. There are societal and neighborhood influences, such as bike accessibility, stores with fruits and vegetables, and the location of the nearest playground. Family decisions, too, are important—like how often we eat out, or what size portions are we used to eating.

- There is some good news, though—the rate of obesity in children has leveled off over the last several years, perhaps in part because of better education and by parents and doctors taking a more active role in prevention. And we know that increased exercise, even if it doesn't lead to weight loss, does improve a lot of the functional consequences of obesity.

Suggested Reading

Satter, *Child of Mine.*

———, *Your Child's Weight.*

Questions to Consider

1. Why has obesity become more common in children?

2. How can obesity be prevented?

Lecture 7

The Critically Ill Child

Though they're by and large healthy and strong, children are vulnerable. Their immune systems may not be fully prepared to defend them, especially if they haven't had all of their vaccines yet. They're often, essentially, showered with infectious organisms in schools and daycares. And the younger ones can't even talk yet, so they can't tell us exactly what's going wrong. When things go wrong, they can go very wrong, very quickly. This lecture presents two patients, and we'll go through them a little more quickly than usual. The aim is to answer: How do you tell a genuinely, scarily sick child from a child that's going to be OK?

Meeting Chloe

- Our first patient is Chloe, a six-day-old newborn, who's coming in today for a routine recheck. She's the first child of a young couple, and was born after an uneventful, normal pregnancy. There had been no abnormal screening tests or ultrasounds, and the delivery and hospital stay had been routine. Her mom is exclusively breastfeeding.

- This first recheck is a very important visit. We expect babies to lose weight, at first, and go home from the hospital still losing weight. But by day four or so of life, a baby's weight should hit the bottom and start climbing back up. The most important thing to check at this visit is whether or not a newborn is getting enough to eat. It's also an important time to check a baby's color, overall strength and tone, and breathing.

- Chloe seems to be nursing OK, and her parents say she's a quiet, content little baby. Chloe weighed 7 pounds at birth, and at hospital discharge three days ago she weighed 6 pounds,

10 ounces. Today, three days after that, she's lost more weight, down to 6 pounds, 6 ounces. That's not a disaster, but by now she should be gaining back, and heading back towards birth weight.

- Her other vital signs: Her temperature is 98.2 degrees Fahrenheit; her pulse is 188; and her respiration rate is 72 breaths per minute. These vital signs are very abnormal.

- Normal newborn vital signs look different from those of older children and adults. Their respiratory rates are faster, their pulses are faster, and their blood pressures are lower. Having said that, Chloe's vitals are still very abnormal, even for a newborn. Her respiratory rate should be less than 60, and her pulse should be less than 150. Instead, they're 72 and 188.

- Although we often skip blood pressures in babies and children under three, in a situation like this with a baby who's not right, we need that blood pressure measurement. We'd also like a pulse ox (pulse oximeter) to check the oxygen saturation in the blood. While our nurse is getting those extra vitals for us, let's examine Chloe.

- Her color is not good—she looks gray—and her extremities feel cool. When we press on the skin on her feet, pressing out the pink color of the blood, the color doesn't return quickly—the skin just stays pale. That delayed capillary refill is a sign of poor circulation.

- Her pulses are weak, her heart is beating fast, and her breathing is fast and shallow, like she's panting. This all means that Chloe is a critically ill baby, one nearing circulatory collapse. We do need to figure out why—but first we'd better do what we can to stabilize Chloe and get her to the help she needs.

- We start with what are known as the ABCs:

    - Airway: We make sure that Chloe's airway is open—and if it weren't, we'd take whatever steps needed to open it up. Hers is open.

- Breathing: We make sure that Chloe is breathing, and if she wasn't, we'd start breathing for her. In a medical office, we wouldn't use direct mouth-to-mouth resuscitation—we'd use a device called a *bag mask ventilator*. She's breathing rapidly, so breathing is OK.

- Circulation: You first make sure that the heart is beating, and if it isn't, you start to give chest compressions. In a newborn, chest compressions are done using just a few fingers on the chest, pushing down and letting up. Chloe's heart is beating, but we know her circulation is poor.

- Next, we arrange for more help. After a brief explanation to mom and dad, we call for an ambulance to get Chloe to the nearby children's hospital as soon as possible. While waiting, we'll put an oxygen mask on Chloe—that may not fix her circulatory problem, but it may help her deliver more oxygen to her tissues.

- Within just a few minutes, the ambulance crew is there, they recheck the vitals, and they take off with Chloe and her mom. There wasn't quite enough room for her dad, but he'll follow behind in their car.

Wrapping Up

- To wrap up this first case: What happened to Chloe? With a baby before birth, almost all of the blood exiting the heart ends up flowing though the umbilical cord to get oxygen and nutrients from the placenta.

- Once that cord is clamped shut at birth, the placental circulation stops completely. All of that blood has to be shunted back through the lungs. There are multiple changes that take place to make this process work. One of them is the closure of a tube that before birth connected the pulmonary artery to the aorta. The tube is called the *ductus arteriosus*, or "ductus" for short.

- It turns out that something went wrong in the development of Chloe's circulation. Chloe had a congenital malformation of her aorta, called a *coarctation*, which is basically a blockage of flow. While her ductus was open, blood could bypass the blockage by going through that ductus—but as it closed after birth, blood could not get into her body's circulation.

- That's why her heart was beating so strong and fast, yet her pulses and blood pressure were weak. As her ductus started to shut, less and less blood could get through her aorta—and if it had shut completely, Chloe would not have survived. Luckily, modern-day screenings often help root out such problems.

Vinny

- Our second patient today is Vinod, a nine-year-old boy who goes by Vinny. This is Vinny's third visit to your office within a week; the first two visits were for fever and coughing, which did not get better. His parents kept bringing him back under your instruction to do so if he didn't improve.

- He's already been diagnosed by X-ray with pneumonia, and he's already on antibiotics. He seems kind of quiet and withdrawn. His vital signs today include a temperature of 99.2 degrees, pulse rate of 146, 20 respirations per minute, and normal blood pressure.

- The pulse rate of 146 is really high, especially when two days ago, while he had a fever, his pulse was 98. We'd better find an explanation for that.

- One possible cause is dehydration. Vinny can't remember the last time he urinated, so you ask him to pee in a cup as a way to see if he's dehydrated. We can quickly test urine in our office to see how concentrated it is—and very concentrated urine correlates well, in children, with dehydration.

- That's when you get a surprise. The urine itself isn't concentrated—so he's probably not dehydrated—but it's a brownish color. The main cause of brown urine we're thinking about is called *hemolysis*, a condition where red blood cells burst, releasing their hemoglobin and other proteins to float around in the blood. When this happens, the hemoglobin appears brown in the urine.

- That loss of red blood cells from hemolysis can cause anemia and decrease the blood's ability to deliver oxygen. Less oxygen delivery leads to a compensatory increase in heart rate—so that might explain what's going on with Vinny.

- We next measure a finger-prick sample of blood to see if Vinny is indeed anemic. And he certainly is—with a hemoglobin of 6, instead of the normal 11 or 12. With that decreased hemoglobin, he certainly will have poor energy, and he'll also have an impaired ability to fight off infection.

- You head back in to discuss this with the family, and what you see isn't encouraging. Vinny is now lying down, and looks worse. He's fallen asleep, which is very unusual for a nine-year-old at a doctor's office.

- His pulse is even faster, and he's now developing purplish bruises on his legs and belly. Those purple bruises, especially in a child who you know has a low red cell count, probably indicate a problem with Vinny's platelets, the clot-forming cells of the blood. The diagnosis of pneumonia now seems to be the least of his problems.

Shock?

- The overall picture, here, suggests that Vinny may be slipping into shock, which requires urgent intervention. Shock is a physiologic state where the circulation is inadequate to supply the body's tissues with oxygen and nutrients.

- There are many pathways to shock, though in the end, the final picture looks the same. Shock can be caused by dehydration, or by the heart being sick and unable to pump. Or, as with our first patient Chloe, it can be caused by a blockage to blood flow out of the heart.

- With Vinny, you're especially worried that this could be evolving septic shock, caused by overwhelming infection. In septic shock, the inflammatory reaction to a serious infection leads to the leakage of fluids out of the circulation into the tissues. Oxygen delivery is impaired, and eventually the heart function deteriorates.

- But one of the most important signs to look out for is a depressed sensorium—that is, acting sleepy, as Vinny is. We do the ABCs and call 911. On the way to the hospital, an IV is placed and fluids pushed—giving fluids is almost always the first treatment for shock.

- Labs are drawn and IV antibiotics are given, and the chest X-ray is repeated. His labs show very low red cell and platelet counts. His kidneys had shut down, putting Vinny in what's called *acute kidney failure* or *acute renal failure*.

- Once the story continued to unfold, it turned out that he wasn't septic at all—he had, instead, developed a condition called *hemolytic uremic syndrome*. The uremic, here, refers to increased urea in the blood, a sign of kidney failure.

- This is a rare but well-known complication of some kinds of pneumonias and *E. coli* infections in the gut. Vinny required dialysis, a medical procedure to filter the blood when the kidneys have shut down. Vinny eventually received a kidney transplant, with his father as the kidney donor.

- All of this started with a bit of a fever and cough. Of course, most fevers and coughs do not turn into this kind of a nightmare. That's the haystack—the thousands of children like Vinny who had a viral cold, or a mild pneumonia, who never require further care.

- But there were some important steps we took with Vinny that at least prevented things from becoming even worse. Rechecking a patient is crucial—even when parents don't want to come back. At every step, we also let the family know when to return, or when to contact us if things weren't going well.

Suggested Reading

Johnson, *Your Critically Ill Child*.

U.S. National Library of Medicine, "Changes in the Newborn at Birth."

Questions to Consider

1. What are the special challenges in treating a critically ill child, as opposed to an adult?

2. How can children be simultaneously more vulnerable and more healthy than older people?

Lecture 8

Getting the Most out of Checkups

So far, we've been concentrating on sick patients—children brought in for a specific medical concern, like a fever, cough, or poor growth. Today we're going to cover some examples of another kind of pediatric encounter: the checkup. These visits aren't meant to focus on a symptom or a known problem. They're more for an overview of what's been going on, to make sure nothing has slipped through the cracks. In pediatrics, we'll use this time to review growth and development—both physical and mental, including learning, communication, and social skills.

Evan's Weight

- Our first checkup is on Evan, a four-month-old infant. You'll start by reviewing the chart, seeing if there have been any past health concerns that we need to review. There's only one, spitting up, which Evan has been doing for the last few months. He hasn't been fussy, and he had been gaining weight well, so Evan is said to be a so-called happy spitter. That's a common pediatric term, and it's meant to reassure parents that spitting isn't usually anything to worry about.

- We also review some developmental milestones. We take a look at Evan's growth percentiles, and he's really quite chunky—he's at the 98th percentile for weight—while his length and head circumference are in the middle of the chart.

- Head circumference is a really important thing for us to track at checkups. An overly big head, or a head that's growing too fast, may be a sign of an important and treatable brain condition; overly small heads worry us too.

- As we go through the physical exam, we talk with Evan's parents about their daily routine, and about what Evan is like. One thing seems clear: He likes to eat, and fusses when he doesn't get a bottle quickly. His parents often put rice cereal in the bottle to reduce his spitting by thickening the formula.

- It looks like Evan's parents have settled on bottle feeding as their main soothing and interacting activity, and it's become, for lack of a better phrase, Evan's main hobby.

- We talk with Evan's parents to demonstrate what kinds of other things might work when Evan's upset. There's holding and cuddling, or doing something silly like putting him on the top of your head and marching around. Or looking at books, or walking around the room and pointing things out.

- This isn't about pointing fingers, but a checkup is a great time for teaching. We also talk about that cereal-in-the-bottle trick. We know that might decrease his spitting, some, by thickening the formula—but it also is giving Evan a lot of extra calories, which he doesn't need.

Kendall's Weakness

- The next child is Kendall, a four-year-old boy that we know well from previous visits. You recall that Kendall had been slow to walk, and didn't start to walk on his own until close to age two. Because of the late walking we had referred Kendall into physical therapy, which he's still doing.

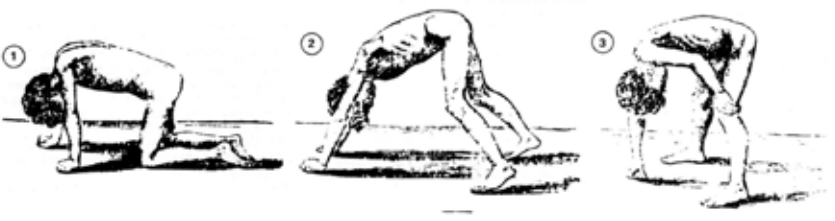
- A few screening tests have already been done by our nurse, including a fingerstick drop of blood to ensure adequate hemoglobin—that's a reflection of iron stores. We've also got the results of both hearing and vision screens—those are especially important to do prior to kindergarten, when deficits in hearing or vision can cause learning problems.

- You let mom know that Kendall's hearing and vision screens were normal, then ask her how physical therapy has been going. "He works really hard at it," she says. "But the therapist says he's not making much progress, and in some ways he may be getting weaker." Talking to Kendall reveals he doesn't play much on the playground, preferring to watch other kids.

- Kendall's reflexes are OK when tested. But when he stands, he has his belly pooched out forward, an exaggeration of what's called the *lordotic curve*. Everyone's lower back is supposed to curve forward, but Kendall's curves forward too much. That can happen when children have poor strength in their pelvis and thighs.

- To test Kendall's strength another way, we have him get down on the floor and watch as he gets back up. He has trouble doing this—he can't just pop up, but leans on his arms to push himself back to a stand. There's a name for this finding: a *Gower's sign*. It confirms that there is muscle weakness, especially in the proximal muscles of the lower limbs, the thighs and buttocks.

Gower's sign



- We normally don't want to turn checkups into visits focused on one medical concern, but we have to talk with Kendall's mom about this. After seeing if there's anything else she or Kendall is concerned about, we circle back to the muscle weakness.

- You tell Kendall's mom that you think some more testing is needed; you're concerned that if anything he's gotten weaker over the last few years. She agrees. You encourage them to continue the physical therapy, order some blood tests, and ask Kendall's mom to make a consult-style appointment a few days later to review the results.

- Kendall's mom says, "What do you think is wrong?" One of the most common causes of problems like this is what's called muscular dystrophy. We don't have a confirmed diagnosis yet, and now isn't the time to try to give mom a ton of information. Still, we'll try to give Kendall's mom some information to get started.

- Muscular dystrophy is a disease of one of the muscle proteins. It usually affects boys, and it causes weakness that gradually gets worse as a person gets older.

- Next, Kendall's mom asks if he can get better. That's a tough question—we don't have the specific diagnosis confirmed yet. You tell her that we don't have all of the information we need, but you'll help by ordering the initial tests, referring to a specialist, and providing the additional consult appointment. You also provide some words of encouragement—helping Kendall will be hard but doable.

Nadine's Answers

- Our last patient of this session is Nadine; she's 14 years old. We haven't seen her in a while—as sometimes happens, older school children and teenagers often stop coming in for routine checkups. That can be a mistake: Kids of every age benefit from a yearly checkup, and having them stay in touch with their own doctor helps kids feel more comfortable if they ever do get seriously ill or have a problem that's worrisome.

- Nadine is here with her dad. He says, right up front, that her mom has moved out and hasn't been in touch. Nadine looks angry and a little tearful.

- Typically we have our patients already undressed and gowned, though they're told to keep on their underclothes, but apparently Nadine refused to take her clothes off. She seems very tense, so you don't push it.

- Nadine has a history of asthma, but she says she doesn't take her medicine anymore. You ask her about symptoms, about coughing or trouble with exercising, and she just shrugs. Her dad interrupts to say, "She's getting a lot of headaches, doc, what can we do about that?"

- You try to get more information about headaches, but Nadine is evasive about the answers. You ask about school, and activities, and friends, but again you feel that you're getting incomplete answers.

- Let's ask Nadine's dad to step outside, so you can talk with her for a minute privately. You reassure her, first, that the exam is over, and you just want to see if she has any other questions. The dad agrees and goes out into the hallway. Nadine is just staring now, down at her feet.

- You talk, back and forth for a few minutes, and Nadine admits that she hasn't actually been to school in several weeks. She thinks her dad knows. Then she asks to show you something, and pulls up her sleeve to the elbow.

- There are a dozen clean, sharp horizontal lines in her skin, all healing lacerations. They're all on her left forearm, and Nadine is right handed—it looks like she did these to herself. This is called *cutting*, or self-injury.

- Nadine implores you not to tell her dad, and says she's not suicidal. This is a very difficult situation. Under most circumstances, our patients should be able to depend on us to keep their privacy—at least under most circumstances.

- We would need to violate that privacy if a child were in imminent danger, if they were suicidal, or threatening to hurt someone else. Or if we were concerned that there could be physical abuse going on—in that case, we're required, by law, to break privacy and report our concerns.

- At the same time, we know that Nadine doesn't have anyone to talk to—she's not in school, so she's not in touch with a counselor there; it sounds like she doesn't spend time with friends, and she doesn't want to bother her dad with this. We might be the only person she's willing to talk to, and if we go against her wishes, we might lose even that connection.

- In the end, we suggested Nadine come back in a week to focus on those headaches—remember the headaches?—and we offered to get in touch with the school regarding her grades, figuring we could maybe connect to a counselor. But the family leaves without even telling us what school she went to.

- It's difficult, sometimes, to think back through a visit like this—there was so much going on, and it's hard to know what problems needed the most urgent attention. The biggest red-flag worry was that Nadine had essentially dropped out of school.

- It's certainly very possible that Nadine had major depression—that's often associated with social withdrawal, and with what are called *somatic complaints*, things like abdominal pain and headaches. We did ask about thoughts of suicide, which she denied, but that's still something we need to consider.

- There was also the cutting. Cutting has become shockingly common in high schools around the country. It's a sign of deep unhappiness and poor coping.

- Other considerations are the possibility of physical abuse, sexual assault, bullying at school, and substance abuse in the home. We'd also want to consider the possibility that Nadine had

questions about her own sexual identity. She seemed very scared of our examining her body—maybe from the cutting, but possibly there was more to it than that. Teens who are gay or bisexual, or even just questioning, are at high risk of depression and suicide, and are at risk of being exploited and abused.

- There's a whole lot here with Nadine that we just don't know. Hopefully, she'll return for that follow-up visit. Even then, we're not going to be able to untangle all of this, but hopefully we could get her plugged in with a counselor or a social worker, and at least get her back in school. That would be a start.

- We'd also like to do a better job evaluating her asthma, and her headaches, and her weight, and encouraging more physical exercise and an improved diet. Those are all things we could have tried to get through during the checkup, but more pressing matters pushed these concerns aside.

Suggested Reading

Benaroch, *A Guide to Getting the Best Health Care for Your Child.*

Bright Futures, https://brightfutures.aap.org.

Questions to Consider

1. Why should children have regular checkups?

2. Should doctors keep secrets they hear from their teenage patients?

Lecture 9

Noisy Breathing

Parents and other family members are more likely than doctors to be there when children's symptoms occur. This is especially true for intermittent symptoms. Sometimes a potentially serious symptom happens that we can't see or hear in the doctor's office, like a car that makes a weird noise on the road but won't repeat the sound once it's in a mechanic's garage. But we still have to take the problem seriously, and sometimes find other ways to get the story. This lecture is about one such case.

Andrew's Congestion

- Andrew is a two-month-old boy brought in by his mom, with a chief complaint of "his congestion is getting worse." Andrew had been in for his two-month checkup with one of our partners last week, and during that visit his mom had said that he seemed to be getting congested.

- If a baby has some congestion, but is otherwise breathing fine and eating well, it's very reasonable to try something simple, like salt-water nose drops, or saline, to gently wash away the mucus. We sometimes also try a small bulb suction device to help suck the nose out. Andrew's mom says she tried that, but it's gotten worse.

- Let's get a look at Andrew. He's in his mom's lap and looks fine—pink and healthy. He doesn't seem congested at all. His breathing is slow and easy. Remember that comparison with the car mechanic? Here's Andrew, with his worried mom, and he isn't making any noise at all.

- You tell his mom maybe it's a cold virus, but he seems great now, so you don't think it's anything to worry about. But you advise

Nose suction

her that if it happens again, she should try to catch it with her mobile phone—take a video or record the sound—and then return with that.

- The next day, she returns with a video, as well as Andrew's grandmother. After introductions, the grandmother says she thinks Andrew might be "wheezing."

- On the video, Andrew makes a kind of high-pitched, noise. He does the noise with every breath, and it seems to be when he inhales. It stopped after about five minutes. His mom called this *congestion*, and his grandmother called it *wheezing*—but in fact, what you heard is what we would call *stridor*. Stridor is a noise made in the upper airway, in the throat or the larynx (sometimes called the *voicebox*). Stridor occurs during inspiration, when you breathe in.

The Differential Diagnosis

- We need to develop a list of what might be going on. This is an important part of the diagnostic process, called a *differential diagnosis*, or sometimes just a *differential*.

- Let's start with a congenital problem—some kind of malformation of the upper airway. It's possible, but it would be a little odd, that a congenital problem didn't appear until now, at two months.

- There could also be something outside of the airway—a cyst, or a blood vessel where it's not supposed to be. Again, you'd expect if it were something physical like that, the noise would be more consistent, and would have been present since birth.

- Infections, like croup, can cause swelling in the upper airway—but Andrew hasn't had a fever and doesn't seem sick. Perhaps it's a neurologic or muscle problem. However, we'd think a muscle problem would affect sucking and swallowing, too. Andrew is feeding well, which goes against the weakness theory.

- How about something in the airway—maybe not congenital, but something that grew or appeared there? One specific example would be what's called *respiratory papillomatosis*, which are growths in the airway caused by an infection with the human papilloma virus.

- These infections are very common, and respiratory papillomatosis can be a very challenging and serious problem. There is now a vaccine that when given to young women can prevent respiratory papillomatosis in their babies—and that is a wonderful thing.

- Another idea: What about a foreign body? Andrew is two months old. He's not picking up toys or putting them in his mouth. But he has an older sister. Is it possible she tried to give him something that shouldn't have gone in his mouth? It's not likely, but it's worth thinking about.

- Time for the physical exam. Andrew seems happy and pink and well. His vital signs, including his pulse ox, are entirely normal, and his weight and growth are fine. He's not making any kind of funny breathing noise now, and his strength seems fine. We've still got a bit of a puzzler so far.

Other Clues

- Let's think of other clues we could look for. Remember, Andrew makes this noise intermittently—that makes you wonder if when he's doing it could be a clue. You ask his mom, "What's going on when he starts doing this? Is it at a certain time?" Eventually, it's revealed that he tends to make the noise after he cries.

- It seems that Andrew's airway is usually normal, but when he cries, he makes the noise. Sometimes in medicine you have to make the tough decisions. In this case, we need to hear Andrew cry. So you pick Andrew up, warn his mom, and then drop him onto her lap from about six inches. The result: He cries.

- Sure enough, after about 20 seconds, Andrew starts to make that stridor noise in between each cry. He's crying, exhaling normally, but when he breathes in, there's the squeaky high-pitched stridor.

- After a minute, Andrew stops crying, but he continues to make that inspiratory noise. When you listen over his chest and neck with your stethoscope, you can tell the noise is coming from the front of the neck, in the upper airway. You try one other physical exam trick—you put him on his tummy, in the prone position, on the exam table. Sure enough, the noise gets better in that position.

- There's a specific diagnosis here: *laryngomalacia*, a physical blockage in the upper airway. In this case it's not a mass, but more of a floppy airway. The airway walls pull together during inspiration, and normally we're born with cartilage rings around the airway to hold it open. In laryngomalacia, the airway cartilage isn't normally developed, allowing the larynx to close during inspiration. That's what makes the noise.

- Though babies with laryngomalacia are born with it, the symptoms don't typically begin until age 4–6 weeks, when babies become strong enough to take more forceful inspirations.

- Gravity, also, has an effect—when babies are lying on their bellies, the airway flops open, but on the back, it's more likely to close. That's why babies with laryngomalacia sound quieter and perhaps sleep more soundly when put down on their front side.

- You let the family know of your suspicions. The diagnosis can be confirmed with one of two different kinds of tests: The options are an airway fluoroscopy, which uses X-rays to take a movie that lets you see how the airway moves; or an endoscopy, where an ENT or pulmonary specialist look down into the larynx with a small scope. This can be done awake or asleep.

- You also discuss with the family the *natural history* of this disorder—that is, what happens to kids with laryngomalacia, with no treatment. The natural history, almost always, is very benign. As babies grow, the airway expands and the cartilage becomes stiffer, and the noisy breathing fades away and almost always stops entirely by age two. There will be some ups and downs, though—crying will continue to make it worse, as will the occasional cold or upper respiratory infection.

- You get a note, a few weeks later: The ENT was able to do a brief endoscopy in her office, peeking down with some topical numbing medicine. Sure enough, Andrew has mild laryngomalacia. The ENT thought there was also some evidence for reflux, too, so she started him on a medication to decrease stomach acid. She expects Andrew to do well, but recommended she recheck him in about three months.

Tying Up Loose Ends

- We mentioned Andrew's sleeping position, which is an important part of anticipatory guidance for pediatricians. We know babies put down to sleep on their backs are less likely to die of SIDS—

that's Sudden Infant Death Syndrome, which is the leading cause of death in babies from one month to one year of age. It's become much more rare since the Back to Sleep campaign to teach parents about safe sleep began in the 1990s.

- But what's the best way for Andrew to sleep? He develops stridor when he sleeps on his back. There are no good studies establishing one way or another if the risk of SIDS from tummy sleeping outweighs the risk of the stridor. At this time, we'd just have to make our best judgment on sleeping position for Andrew.

- Certainly, if he does sleep on his tummy, his parents should be extra careful to minimize any other SIDS risk factors. He should sleep on a firm surface separate from his parents' bed, avoid cigarette smoke, and make sure to stay up to date on vaccines.

- There was also that mention of reflux from the ENT. There is an interrelationship between laryngomalacia and reflux. All babies spit up some, and occasional painless spitting should not raise any medical concerns in the thriving child. But in a child with laryngomalacia, the airway is already a little smaller and prone to close, so any additional swelling or irritation from reflux could potentially make things worse.

- Also, babies with laryngomalacia have to breathe in with more force to get the air through—and that can worsen any reflux. Since reflux can worsen the symptoms of laryngomalacia, and laryngomalacia can worsen reflux, we'll have a very low threshold to start babies with laryngomalacia on acid-reducing reflux medicine.

- Andrew, as we expected, did well. By the time he was 12 months old he rarely made the noise, and when we brought it up again at his 15-month visit, his mom said she had forgotten all about it—it had just stopped, sometime between those visits. At the ENT's suggestion the family discontinued his reflux medication, and he continued to thrive and do well.

Suggested Reading

Lovinsky-Desir, *Laryngomalacia*.

Stern, Cifu, and Altkorn, *Symptom to Diagnosis*.

Questions to Consider

1. How can pediatricians get an adequate history from their patients who are too young to talk?

2. How can parents tell if a baby is having trouble breathing?

Lecture 10

Trouble in School

This lecture focuses on Carter, a 12-year-old boy in the office with his dad, with a chief complaint of sore throat. He's had a fever, too, of 101 degrees at home. But those symptoms, and their eventual diagnosis, turn out to not be the most important part of Carter's visit. Instead, the appointment evolves into a discussion of Carter's apparently longstanding problems in school, and how he and his parents can move toward solving them.

Meeting Carter

- Carter's symptoms—sore throat and fever—started two days ago. On the exam, Carter looks well. The lymph nodes in the front of his neck are just a little swollen—they feel like marbles—and his tonsils, in the back of his throat, are red; they're swollen too. The remainder of the exam is normal.

- As per protocol in your office, children who present with both a fever and sore throat have a strep swab done right up front—the nurse takes it early in the visit. The test is already "cooking," as we'd say, and should be completed in just a few minutes.

- Meanwhile, we talk with Carter and his dad about symptom relief. He may want to take ibuprofen or acetaminophen to help with the fever and the sore throat. He'd also benefit from some extra fluids, and maybe a milkshake or a fruit smoothie. Your nurse pokes her head in through the door and tells you that the strep test came up positive.

- The rapid test we do in the office detects antigens—basically, specific proteins—that are made by strep bacteria, specifically

a species called *Streptococcus pyogenes*. If it's positive, it's a reliable indicator that there are strep bacteria in the throat.

- You explain to Carter and dad that he needs a course of antibiotics, but dad's not too thrilled about that—he's heard about the dangers of the overuse of antibiotics, and would rather Carter not take any.

- On the plus side, taking a course of antibiotics will shorten the disease, prevent its spread, and prevent rare complications. There are risks of antibiotic use, too, including allergic reactions, other side effects, and the potential development of antibiotic-resistant superbugs. Still, with proven strep in Carter, current recommendations support the use of antibiotics.

- When the appointment is seemingly over, Carter's dad says: "Oh, yeah, doc, I meant to talk to you about school, too. Carter's having a hard time in middle school. His mom and I were wondering if he has ADD or something."

- This is the downside of keeping your eye on the clock, as a doctor. We could end this quickly by saying, "You should go talk to the school counselor," or maybe by saying, "We're out of time, you should go make another appointment." Either of those statements would be factually true. But they wouldn't be good medical practice. Taking care of patients is more important than watching the clock and staying on time. We don't want to keep people waiting, but we don't want to blow off someone who needs help, either. It's a balance.

- Questions with Carter and his dad reveal that he did well enough in school until this year. He started out OK, but has gradually gotten worse grades, and now he's failing two classes. They started some extra tutoring, but sometimes it seems like the information doesn't stick in his head.

The Differential Diagnosis

- First, we'll think about what could be going on here, at least in broad terms, so we don't overlook any important categories. Perhaps it's something simple: Maybe Carter just isn't getting enough quality sleep, or maybe there's a lot of discord and arguing in the house.

- Has he been sick, maybe, and missing a lot of school? Could he have a problem with vision, or hearing? We'll need to think about school, itself, too—does Carter feel safe in school? Has there been bullying?

- Perhaps there's what's called a *mood disorder*: depression or an anxiety disorders. Kids with these issues will have a hard time staying focused on their work in school.

- Speaking of focus, his dad had asked about ADD (attention deficit disorder). That's a disorder that can encompass three key symptoms: poor attention or focus, impulsivity, and hyperactivity. Not all three of those symptoms have to be problematic to diagnose ADD, but at least some of them have to cause trouble in multiple areas of a person's life.

- But maybe it's our expectations of academic achievement that are wrong. Maybe Carter has a low IQ, or low intelligence. We call this *intellectual disability* now—other names have been used for this in the past. We want all kids to thrive and do well, but some kids may have a different intellectual potential than others.

- Carter may also have what's called a *learning disability*. These are conditions in children who have a normal (or even superior) IQ, but in one or more very specific areas they struggle, perhaps in math or in reading. Deficits in memory or the processing of information can fall into this category, too. The traditional definition of a learning disability is a condition where people have more difficulty acquiring knowledge or skills than we expect for their age and intelligence.

- That's a long list, but the point of thinking about a differential diagnosis is so we don't overlook something important, or something that we could definitively treat quickly. In a case like this, we'd want to know if there were any conditions that could cause immediate danger first. We'll ask a few questions to look for those.

- We ask: "Carter, how do you like school?" Carter says he does still like school, but language arts class gets him down. He likes science, and likes to hang out with his friends. While talking, you watch his body language, too—he doesn't seem down or depressed, but acts animated when talking about his favorite parts of school. First impressions point away from depression or bullying here. But those were very important things to explore.

- It turns out that Carter is failing two classes, math and language arts, though he says his math teacher is really good and tries to help. He's been doing extra tutoring with those two teachers. His other classes aren't going so well, either.

- "How are things at home?" you ask. Carter says they're good, and his dad says, "He's a great kid, I just feel bad for him that school is such a struggle this year."

Plans

- It doesn't sound like there's any immediate danger here, but we need more information. We give Carter's dad a few handouts—some general information about school problems, learning disabilities, and attention deficit disorder.

- We give his dad copies of some forms to fill out—checklists, for him, Carter's mom, and teachers to do, with standardized questions to help get more structured information from the people who know Carter best.

- We also ask Carter's dad what the school has done. He says his wife takes care of that; he thinks they're doing some testing.

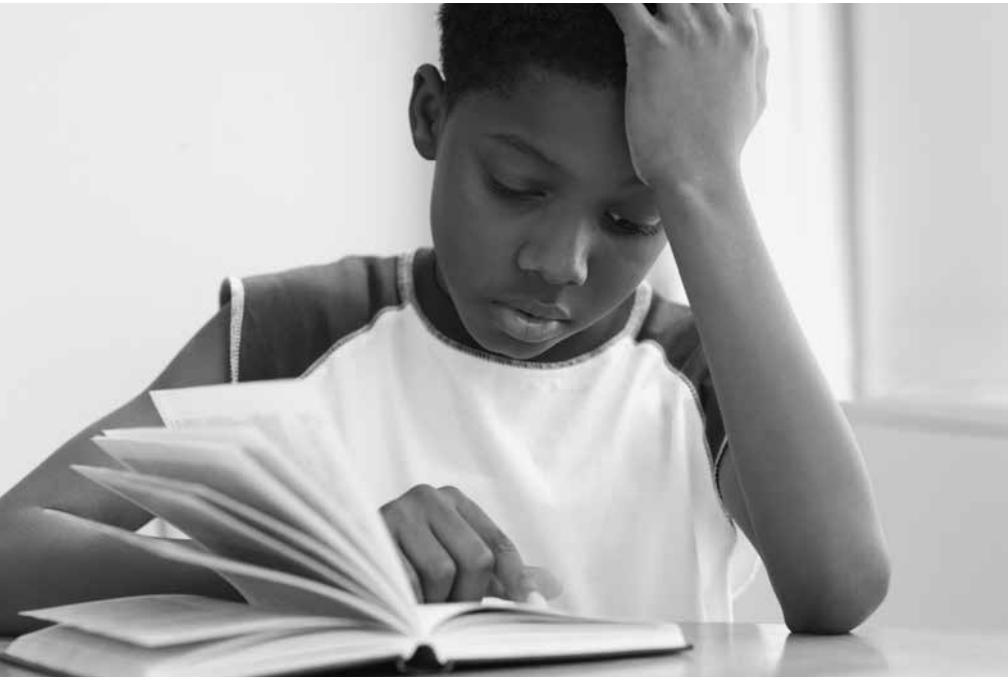
Finally, you ask him to make another appointment to review this information and decide on the next steps. That next appointment will be set up as a consultation, with just the parents, so you can speak freely with them to answer all of their questions.

The Consultation

- It's a few weeks later, and we have a consult set up with Carter's parents. They sent paperwork over from the school, including a detailed report called a *psychoeducational evaluation*—testing done by the school psychologist.

- The summary here is that Carter has a normal IQ, but he has specific deficits in reading that meets the criteria for a specific learning disability called *dyslexia*—a learning disability that mostly relates to communication via written words and language. He also has many characteristics of attention deficit disorder.

- We go over the diagnosis of a learning disability in reading, and what dyslexia means, and how the school and parents can help.



And we review his sleep, diet, and exercise history to make sure Carter has good lifestyle habits.

- Carter's dad wants to know if there are any supplements or anything he can take that can help. There are a lot of herbs and supplements sold to help children do better in school, but most of them are of very questionable value, either with no studies supporting their benefit or with only small studies done by the manufacturer. Certainly, a healthy and varied diet is a good idea. There is one specific dietary supplement with limited evidence of effectiveness—an omega-3 fatty acid supplement, often sourced from fish oil.

- Then you review the rating scales they and Carter's teachers did. All of them rated Carter in the at-risk category for attention deficit disorder. It looks like he may have that in addition to the learning disability. It's common to have a so-called comorbid condition with ADD, meaning a second diagnosis at the same time.

- Before talking about the nuts and bolts of ADD though, it's a good idea to try to understand the patient as a person, as an individual, and to not start out by thinking of Carter as a diagnosis. Let's ask his mom and dad: "What's Carter like?" They say he's adventurous pleasant, and outgoing. The summary is he's a good kid—great at a lot of things, but not so great at school right now.

- You go through what you'd recommend: First, deal with the dyslexia. That's mainly the school's job, but his mom and dad need to read about it and understand it too. And at least some of the lack of focus may be directly related to the dyslexia.

- Improving his reading won't be a quick fix; it's going to take time. So we should consider working on other ways to help him with his attention and focus. There are classroom accommodations that can help, things like sitting in front and keeping distractions away. We also want to make sure, if possible, that Carter has active play time every day, to work off energy.

- You also encourage his family to make sure Carter stays in touch with the school counselor, to keep tabs on his mood and self-esteem. Doing extra reading work may help, but it may also, potentially, make him more discouraged, especially at first.

- Medications can be part of the treatment for ADD, but they shouldn't be the only part. The medicines usually work well to improve the main symptoms of ADD. Their effects, though, are brief—once they wear off, all of these behaviors return. They can have side effects, too, but again, those are brief. Staying with low doses and adjusting upwards slowly, if needed, will be the best way to avoid side effects.

- At the end of the visit, Carter's mom and dad decide to hold off on medication for now, and to concentrate on helping him with his reading and addressing the ADD in other ways. That's very reasonable. They should plan for a return visit with Carter in a month or so. We can always reconsider the plan then.

Suggested Reading

Barkley, *Taking Charge of ADHD*.

Solomon, *The Noonday Demon*.

Questions to Consider

1. Is "having trouble in school" a medical problem, or a problem that doctors can help with?

2. What sorts of lifestyle habits contribute to school failure?

Lecture 11

The Premature Baby

In August 1963, for the first and only time in American history, the first couple had a baby. Patrick Bouvier Kennedy was expected to be born in September, but arrived about five and half weeks before his due date. Thirty-nine hours after his birth, Patrick Bouvier Kennedy died from a complication of prematurity: what used to be called *hyaline membrane disease*. We've made tremendous strides since then. For this lecture, rather than concentrate on a single case, we're going to concentrate on a single location: the neonatal intensive care unit, or NICU. Such a place didn't exist in the early 1960s, but it's now an essential part of any hospital with an obstetric unit.

RDS

- In the early 1960s, hyaline membrane disease was the most common cause of death among premature babies, killing about 25,000 babies each year in the United States. Hyaline membrane disease is now called *respiratory distress syndrome*, or RDS. We know now that it is caused by a lack of what's called *surfactant* in the lung's air sacs. Surfactant decreases the surface tension of water, allowing the lungs to easily expand.

- Human lung tissue makes its own surfactant, but that doesn't start until babies are near their due dates. Without surfactant, it's difficult to expand the lungs, so breathing is difficult and less effective.

- Modern care of RDS relies on two innovations. One is mechanical ventilation, now a cornerstone of the ICU care of children and adults. Ventilators didn't become widely available until after Patrick's death. The other innovation is that we can now administer

surfactant to babies, giving it through the same tube that attaches to a ventilator.

- If Patrick Bouvier Kennedy, who weighed 4 pounds 10 ounces, were born today, he almost certainly would have survived without any major complications or problems. A 34- or 35-week baby (born earlier than the expected 40 weeks) who weighs over four pounds would be a fairly routine admission for a modern NICU, and wouldn't even begin to push the boundaries of what we now do.

Modern Care

- Not all babies who need NICU care are premature babies. Our first patient today is Oliver, who was born at 40 weeks—that's term—after an uneventful pregnancy with normal prenatal screening tests.

- The mother's water had broken about 40 hours before delivery, which was by Cesarean section (or C-section) after what's called a *failure to progress*. Oliver's mom tried labor, and actually tried it for a long time, but the baby just wasn't making his way out.

- As long as mother and baby are doing well, when to offer to do a C-section is a judgment call—but the mom started running a fever, which is concerning because once the membranes are broken before delivery, bacteria can cause an infection that can make both mother and child seriously ill. Since labor wasn't progressing, it was a reasonable time to get Oliver out.

Virginia Apgar

- At birth, Oliver was pink and healthy. His Apgar scores were 9 and 9. That's a scoring system used to judge the health of a newborn. The scoring system gives from 0–2 points in each of 5 areas, including color and breathing effort, so a newborn could get a theoretical high score of 10. When we say, "Apgars of 9 and 9" we mean it was 9 at one minute of life, and 9 at five minutes. That's perfectly fine.

Oliver's Grunting

- After his birth, Oliver was sent to the term-normal newborn nursery. When he was five hours old the nursery staff became concerned—they used the chief complaint, "he's grunting."

- *Grunting* refers to a breathing pattern that's seen in newborns and other very young babies when they're having trouble breathing. It's basically exhaling against closed vocal cords, so every breath makes a little grunt.

- Though grunting can be a sign of respiratory trouble, it can also be a sign of low blood sugar, infection, heart disease, or other things. With newborns, it's always important to be on the lookout for any signs of illness, and then to cast a wide net when you think about possibilities.

- On the exam, you note that Oliver is indeed grunting, making a little noise with every exhalation. Also, his nose is flaring open as he breathes, his ribs are poking out with each breath, and his abdomen is moving up and down, too—these are all signs of trouble breathing. Though Oliver's pulse ox is 95%, which means his blood is adequately oxygenated, he's working hard to do it.

- The remainder of his exam is normal. Even though his pulse ox is fine, you ask the nurses to put him on a little extra oxygen via what's called *blow-by*—a little extra inspired oxygen.

- After a quick visit to meet and update his parents, you return to Oliver. His pulse ox has dropped to 92%. His CBC (complete blood count) shows an elevated white blood cell count with a

high proportion of very young cells called *bands*. This suggests a bacterial infection is going on. On his chest X-ray, the right lung looks hazy. This is the picture of neonatal pneumonia.

- Oliver will be transferred into the NICU for further care. There, he'll go on to receive an IV for antibiotics. He'll also Oxygenation monitoring, followed by more intense oxygenation. He will need oxygenation monitoring, followed by more intense oxygenation, and he will be fed through a small tube.

- Oliver had trouble nursing and bottle-feeding. Once she recovered from surgery, Oliver's mom was encouraged to spend time in the NICU, holding Oliver and trying to nurse. She and Oliver's dad were also taught how to help with the tube feeds. After two days, Oliver didn't need extra oxygen, and began to feed better. He was sent home nursing and in good shape after a nine-day NICU stay.

Premature Babies

- Oliver was a *term baby*, a baby born at or after 38 weeks of gestation. But many of his neighbors in the NICU were premature. Being born too early is the single biggest contributor to newborn health problems, and the earlier a baby is born, the more trouble there's likely to be.

- In Patrick Kennedy's day, being born even five or six weeks premature pushed the limits of living and dying. Now, some babies born as early as 23 weeks—almost four months early—will survive with high-tech ICU care, though most will have significant long-term health problems.

- There hasn't been a lot of progress made towards the prevention of premature birth. But there are some things we know can increase the risk of an early delivery, like twins or other multiple gestation, in vitro or assistive technology conception, anomalies of the uterus, poor nutrition, or chronic health problems in the mother. Moms who take illicit drugs, smoke, or drink alcohol are

also at increased risk of premature birth, as are moms who don't get good prenatal care.

- Though we can't necessarily prevent premature births, we can now do some things to help once it's started. Pregnant moms can be given steroids, medications that accelerate the maturation of fetal lungs. If mom goes in to labor early, we can sometimes slow labor down enough to give steroids time to take effect. These antenatal steroids can prevent or at least lessen the severity of respiratory distress syndrome in newborns.

Ginny

- Our next patient is Virginia (she goes by Ginny), and she was born at 28 weeks, about three months before her expected due date. Her mom went into labor shortly after an automobile accident—that may have been the cause—and she was given antenatal steroids before Ginny was born. There had been no other issues during the pregnancy. At birth, Ginny weighed two pounds.

- Babies born this early look different from term babies, and if there's time before delivery it's a good idea to warn mom and dad. They haven't put on any fat yet, so they look really thin, and they're often covered with a fine downy hair called *lanugo*. Their eyes stay closed, usually, and they don't move as much as a term baby after they're born.

- At birth, babies born this early always need some extra help. Ginny didn't breathe well, and was given surfactant and then put on a device called CPAP, short for *continuous positive airway pressure*.

- Patients like Ginny may also require these measures:

    - IV access for blood tests, fluids, and medications

    - An incubator to keep the temperature and humidity at optimum levels

- □ Medication to close the ductus before any circulation problems begin

- □ Ultrasounds of the head to detect bleeding in the brain

- □ Monitoring of hearing and vision to catch problems

- Ginny had some ups and downs, but overall grew well, gaining about an ounce or so a day. Two months after she was born, when she was still about three weeks shy of her due date, her weight was just over five pounds. She was breathing on her own and taking both breast and bottle feeds.

- She was ready to go home. Ginny will have to continue close follow-up for her nutrition, growth, and eyes; we'll be sure to keep an eye on her milestones and development too.

Samantha

- Let's meet one more baby: Samantha, a little girl born yesterday at 36 weeks. There were no prenatal risk factors. The nursery summons you because she's not nursing well.

- Vital signs now include a normal temperature and blood pressure, but her pulse is 180 beats per minute and her respirations are 80 per minute. Both of those are fast. On the exam, her lungs are clear and there is no heart murmur. You ask the staff to check a pulse ox while you check in with her mom.

- Samantha's mom says she just doesn't know what's wrong; she's nursed babies before, but Samantha just won't stay on. She'll latch for just a moment, and then spit the breast out.

- We go back to see Samantha, and the nurse has a worried look. The pulse ox is 88% on room air, lower than the 95% it should be. Samantha's still breathing fast, but she's not working hard and doesn't seem sick.

- Does Samantha have what Patrick Kennedy had, RDS? Usually, those babies are working to breathe. Yet Samantha's breathing is fast, but unlabored.

- You ask the nurse to put the baby on an oxygen mask, temporarily turning the flow way up so she gets lots of oxygen—and her pulse ox doesn't budge. It stays at 88%. That's your clue: If Samantha had a lung disease, extra inhaled oxygen would bump up her pulse ox.

- This must be heart disease—congenital heart disease. In this case, a later echocardiogram shows Samantha was born with a heart defect called *transposition of the great arteries*, where her aorta and pulmonary arteries were out of place.

- Her lungs worked, but the red oxygenated blood from her lungs was mixing with un-oxygenated blood from her body because the tubes circulating the blood were connected the wrong way.

- In the short run, medication was used to support Samantha's circulation. When she was a few weeks old, a cardiothoracic surgeon performed an arterial switch operation, repairing the anatomic problem. She stayed in the hospital for two weeks after the surgery, and was then sent home in great condition, feeding well and growing. We'll keep an eye on her growth and development, but Samantha now should do well.

Suggested Reading

Gunter, *The Preemie Primer*.

Ryan, *Patrick Bouvier Kennedy*.

Questions to Consider

1. When a baby is born early, what kinds of problems can parents expect?

2. How has our approach to prematurity changed in the last 50 years?

Lecture 12

Pain as a Warning Sign

Pain is a part of every life, including every child's life. Kids have stomach pains when they eat too much ice cream, and headaches when they're worried about school, and throat pain when they get one of the dozens of upper respiratory infections they'll endure. Most pain, of course, is innocuous and fleeting. But which pain needs to be evaluated? Which pain really should make parents worry? In this lecture, we'll explore those questions with a patient experiencing pain.

Clark's Parade of Specialists

- Our grand rounds patient today is an eight-year-old boy named Clark. His chief complaint is, "It hurt right here yesterday, but it doesn't anymore." Clark's mom says he's had this pain on and off for a few days, but yesterday it seemed worse, so they made this appointment. She thinks it was just because he got new shoes, and had to break them in.

- Since they're already here, you ask Clark where it's hurting. He points to the top of his right leg, as the crease of his thigh and groin. Pain here, or really pain anywhere, can be caused by a wide variety of things.

- Today we're going to look at a new, different way to start thinking about a list of possible diagnoses. Let's think from the point of view of medical specialists, the people we might refer to if we need help. If Clark here were in front of a specialist, like an orthopedist or a cardiologist or an infectious disease specialist, how would they think about pain, and what kinds of questions would they ask?

- An orthopedist—concerned with the musculoskeletal system—would probably first try to figure out what part is broken—that is, what anatomic thing is causing the pain—and then what the mechanism of the injury or impairment was. Clark's orthopedic exam, today, is normal, and the orthopedist would probably not do any further evaluation.

- What if Clark were to see a rheumatologist? Their sphere includes diseases of muscles, bones, and joints caused by medical disorders such as lupus or inflammatory arthritis. With Clark complaining of pain, perhaps in his hip joint, one might think a rheumatologist would be a good resource—but in fact, juvenile arthritis causes more stiffness or swelling than pain.

- An infectious disease physician would ask about other signs of infection, like a history of fever, and would also want to know if Clark were at risk for infections, perhaps if he had an immune deficiency or had specific exposures to an infectious agent. On the examination of Clark's hip, there were none of the typical signs of infection—swelling, redness, or pain—so an infectious disease specialist would send Clark home.

- A GI specialist would focus on other symptoms of GI problems, like diarrhea, constipation, or vomiting, and they'd want to know if Clark were losing weight. Some GI disorders like Crohn disease can cause arthritis, or joint pains. Still, Clark today denies any symptoms of GI problems, and his GI examination reveals no problems.

- Pain is sometimes the presenting symptom of blood disorders or cancer. Hematology looks at diseases of blood, and oncology, cancer. A hematologist, especially if there was a history of anemia or if Clark's ancestors were from an area of the world with blood disorders like sickle cell anemia, might think about looking at a smear of Clark's blood under a microscope. But Clark has had no history to suggest a hematologic disorder.

- What about cancer? It's rare in children, though not as rare as you'd think—cancer is actually the most common cause of death of children past one year of life, with about 16,000 new pediatric cancers diagnosed in the United States each year.

    - An oncologist will first focus on what are called *constitutional symptoms*, like fevers, weight loss, or night sweats—these are symptoms that affect the whole body. They'd also look for some specific things on the physical exam, like enlargement of the spleen or liver or lymph nodes, or paleness of the skin—that could indicate anemia, or not enough red cells.

    - There's also a skin rash called petechiae, caused usually by a problem with the platelets, the clot-forming cells of the blood. A child who has pain plus petechiae is a child that needs more evaluation. Clark has none of these findings, and the oncologist would have reassured the family and sent them home.

- There's one more specialist: a psychiatrist. Clark is otherwise doing well, he seems happy and secure, he's got lots of friends, and he says he has no worries at all. So for him we can safely leave psychiatric disorders on the back burner.

- For now, we're thinking that none of these specialists really needs to be involved. So who's the best doctor for Clark, today? A generalist—a pediatrician or family practice doctor. Such a doctor will cast a wide net, take the kind of history that combines what every specialist would ask, and do a careful examination of all of the organ systems. That's our job, today.

Moving Forward

- We've asked a lot of questions of Clark and his mother, and we did our careful exam. We didn't uncover any red flags that would make any specialist worry, so we tell Clark and his mother not to worry, either. But you leave the door open, saying they should come back if symptoms get worse or new ones appear.

- Clark comes back five days later with both parents. The pain in the front of the right leg has come back, and it's more persistent now. And there's new pain, running down that right leg towards the knee. Clark is having trouble walking on it. Clark has also been inactive lately; he says he hasn't felt like going outside lately and has been "tired." There have been no fevers or any other new symptoms.

- On the general exam today you don't find anything new or concerning. We're going to focus the differential, now—worsening pain, with no history of trauma, and an essentially normal exam.

- This could still be trauma, some kind of bruise or pulled muscle, perhaps—but why would it be worsening? Clark has kind of put himself on rest, here—the family says he has not been active—so worsening pain doesn't quite fit trauma.

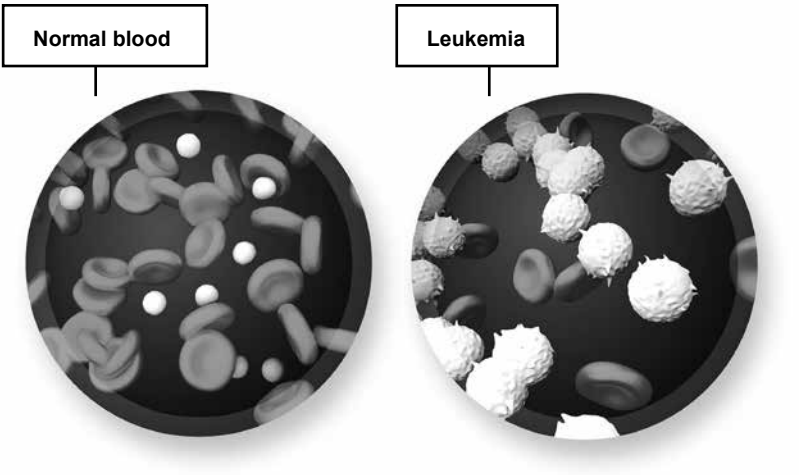
- What about growing pains? Those are a common cause of lower extremity pain in children, though in this case it really doesn't fit. Growing pains occur mainly at night, and don't cause a limp or trouble walking during the day. Also, they don't tend to be fixed in one place.

- X-rays are done of the hip joint, including the pelvic bones and the femur down to the knee, and they're normal. This rules out slipped epiphysis (a hip disorder), and also makes a fracture unlikely. A stress facture might slip past an X-ray, but Clark hasn't been active enough to make a stress fracture likely—they typically come from repetitive actions.

More Tests

- The next test we check in Clark is a CBC, or complete blood count. From the CBC, we first notice that Clark's red cell count is down—in other words, he's anemic. But we don't know yet why Clark is anemic.

- The second cell line in the CBC is platelets, very small cells that help form clots. High platelets are associated with infections and



inflammatory conditions, and low platelets with widespread clotting or with a failure of production. Clark's platelet count is also low, though not low enough—yet—to cause bleeding.

- Clark's white cell count is extremely high. Ordinarily, the white count is about 5,000, or 10,000–12,000 during a mild infection, or even 25,000 during an intense infection like pneumonia. Clark's white cell count is 75,000.

- The differential shows many cells called *lymphoblasts*—young, immature white cells that ordinarily are only found in the bone marrow. Seeing these cells in the circulation is very suggestive of leukemia, a cancer of white blood cells.

- Unlike typical solid organ cancers, like breast cancer or skin cancer, leukemia is also always a systemic disease when it's first diagnosed. Those cancer cells are in the blood, and they've spread everywhere. They fill the marrow, causing bone pain; they can also fill up spaces in the spleen, liver, and lymph nodes, often causing enlargement of those organs. Many patients have fevers when they present with leukemia, either from infection or from the out-of-control immune reaction to all of these circulating

cells. Anemia, low platelets, and overwhelming infections are all contributors to death from leukemia.

Talking to the Family

- It's time to talk with Clark and his family. We don't have all of the answers—a more specific and definite diagnosis of leukemia requires more tests and a bone marrow biopsy—but with what we know about his symptoms of increasing pain and his very abnormal CBC, leukemia is the only likely diagnosis.

- Now is not the time to get into all of the details about this, but we do want to quickly get the ball rolling and get Clark to the resources he needs. He'll be admitted to the hospital; there, the oncology team will spend a lot of time with him and his family for teaching and education and support. They're the experts in leukemia. But we're the ones here, now.

- There's no single right way to break this kind of news, but for a child who's eight it's usually best to speak with the parents alone, first. You go somewhere quiet and private, and you let them know that these blood tests show something you're worried about. His blood tests show that he has a lot of abnormal cells in his blood, and these are probably cells of leukemia.

- The family is going to have many long days ahead of them. There will be a lot of days when Clark won't feel well. But with therapy, most children with leukemia can be cured. You give them some time to themselves, and make a phone call, and arrange for a pediatric oncologist to meet them in the emergency department for admission.

- You have to tell Clark, this, too—or at least, let him know that he's going to the hospital to help take care of his blood. You tell him that his parents will accompany him, and you'll be checking in too. But you've got some great friends who are great blood doctors, and one of them is going to be in charge, because Clark needs the best.

- You also tell Clark's parents that progress in the treatment of childhood cancer, and childhood leukemia specifically, has been amazing. In the 1950s, leukemia was uniformly fatal within a few months; now, the overall cure rate in children—that is, no return of disease, ever—is well over 80% for the most common kind of childhood leukemia.

- Most children undergoing therapy do so under a trial, so their outcomes are tracked and compared with the outcomes of children treated with different protocols and different agents. In a remarkably short time, this has contributed to incredible advances. This is not an easy path—treatment involves many side effects and procedures, and is often protracted over several years. Sometimes, the long-term side effects of treatment can themselves cause health issues later on. But with therapy, there is every reason to be hopeful for children like Clark.

Suggested Reading

Keene, *Childhood Leukemia*.

Weinberg, *The Biology of Cancer*.

Questions to Consider

1. Can pain be measured objectively?

2. What are the "red flags" for the more-serious causes of limb pain in children?

Lecture 13

Better Sleep for the Whole Family

Today's grand round cases are all about sleep—about helping children of any age, and their parents, get a good night's sleep. As you'll see, the clues are almost always in the history—in the few questions we need to ask about what's going on and what's going wrong. And keep in mind, with sleep problems, we really do often have two or three patients in the exam room: a child, and adult caretakers. Our goal is to help everyone sleep better.

Meeting Alphonse

- Our first patient is Alphonse, or Al. He's seven months old, with a chief complaint from his exhausted mom of "he never sleeps." He barely stays asleep for a half hour at bedtime, and then wakes up, again and again, every 30 to 60 minutes.

- There's a myth in play here. We're actually not supposed to sleep constantly through the night. All of us, babies and children and adults, wake up multiple times, as a normal part of our sleep rhythm. But we don't remember waking up, because most of the time we just fall back asleep.

- Our ability to fall back asleep relies on *sleep associations*. These are aspects of our environment just as we fall asleep. With babies, parents often inadvertently teach their children sleep associations that lead to trouble.

- Picture the scenario: Al, seven months old, wakes up about a half hour after falling asleep. If he knows that the way to fall asleep is by being held and nursed, he's going to yell and fuss until his mom resumes those learned sleep associations again. But if Al

has learned that sleep begins in his crib, alone save for his stuffed bear, Al will just fall back asleep.

- To help Al and his family, they need a plan to re-learn better sleep associations. The quickest way to have Al learn new sleep associations is the cold turkey method. This is simple, and it does work, but many families find that it's not easy to do.

    - You go leave the baby alone in a safe place to sleep, and you leave, and you don't keep checking in. There can be a lot of crying with this method, though it usually lasts less than a week. Still, this can seem cruel to many families, and the cold turkey method is not for everyone.

- A more gentle approach is one popularized by Dr. Richard Ferber. With this method, parents go in and recheck a baby only if there's active crying, and gradually lengthen the time between checks as the night goes on.

- There are other methods, too. One, called *slow and steady* or *camping out*, requires a parent to more gradually move away at bedtime. They move from rocking the baby, to just holding them, to lying beside them, to lying nearby, then gradually getting farther away until the parent is no longer part of falling asleep.

- There are also so-called no-crying methods, as well. For any of these methods to work, parents first have to be realistic. Most two- to four-month-old babies still need to eat at night, so active or pushy sleep training at that age is unlikely to work—though it's still reasonable, even at two months, to at least sometimes try to put baby down when she's still awake.

- It's also crucial that parents be consistent. Start with a fixed bedtime routine at the same time every night, go through the same steps, and then stick with the sleep plan the parents have chosen.

Trisha's Bedtime

- It's time for our next patient, a three-year-old girl named Trisha. Bedtime has turned into a two-hour ordeal, including multiple books and sips of water. By the time Trisha is finally asleep for good, it's 11:00 pm and her parents just collapse. They have no evening time to themselves, and that's not good for Trisha's family.

- The technical name for what's going on is *limit-setting sleep disorder*. Children make demands to push the limits and delay bedtime, and these habits tend to get worse with time. Another term for the demands is *curtain calls*.

- Again, there are multiple ways to help with this problem. The choice depends on how quickly the parents want this issue solved versus how much yelling they think they can withstand.

    - One method that works is the quiet return to bed. The parents, without any further discussion or interaction, quietly take the child back to bed with every curtain call. You have to be monotonous and boring and consistent, and there will be yelling and tantrums, but with consistency this method usually works within a week or so.

    - A more complicated, longer method with less crying might seem better for some families. One way to do this is to go through the routine, including a set number of requests for books or water or hugs. Then, at the end, you leave the child with a certain number of tickets, say three of them, that can

Typical Sleep Needs

Babies and toddlers: up to 14 hours

School-age kids: 10–12 hours

Teenagers: about 9 hours

Adults: about 8 hours

These are based on consensus numbers from the National Sleep Foundation. Everyone's exact sleep needs may vary.

be turned in for extra requests. Each request costs one ticket, and the child has to hand a ticket over. When the tickets are gone, no more requests will be honored.

Edward's Brain

- Our next patient is Edward; he's nine years old, and he's having trouble falling asleep. He has good sleep hygiene habits: a consistent bedtime and avoidance of caffeine and lit screens (which simulate daylight) before bed.

- Edward says that when he tries to sleep, he gets a racy brain, and he just can't fall asleep. This has a name: *psychophysiological insomnia*. The bed has become a place for thinking and worrying. In a way, it's a sleep association problem, but in reverse—Edward has learned that lying in bed is a time to think rather than a time to sleep.

- The fix here is to re-establish a sleep association—to enforce the habit that the bed is for sleeping. Edward shouldn't do homework or other things in bed. At night, after a good sleep routine, he should lie in bed to try to sleep—but if he doesn't fall asleep in about 15 minutes, he should get out of bed and do something calm and non-stimulating for a little while, like reading a school textbook.

- No electronics or bright lights are allowed. After a little while, he should get back in bed to try to fall asleep again. He shouldn't look at a clock—in fact, it's better to hide the clocks during this retraining.

- If it doesn't work the first time and Edward stays awake again, he should just repeat this process in approximately another 15 minutes. Waking up should be at a set time, seven days a week, no matter how long it took to fall asleep the night before. Naps should be avoided.

- Edward can also make a list of what's on his mind before dinner. That helps prevent Edward from having to make this "worry list," mentally, while lying in bed.

- If this doesn't work, next think about inquiring about anxiety symptoms during the day. Perhaps this sleep issue is part of a larger problem. But most of the time, a few simple steps can help dispel this kind of racy-brain insomnia—both in kids and adults too.

- Parents will sometimes ask if a medicine can be a helpful part of a solution to poor sleep. Usually not, at least in children—we'd much rather rely on fixing the root of the problem and establishing good habits.

Izumi's Sleepiness

- Our next patient is Izumi; she's 16 years old, and she's here with a chief complaint of, "I fall asleep all the time." Izumi is in 10th grade, and she does well in school—even though, she admits, she almost always falls asleep in class. Her dad interrupts, and says she just sleeps all the time, but she's still always tired.

- More history on Izumi's sleep patterns:

    - She goes to sleep at 11:00 pm and wakes at 7:00 am.

    - That should be plenty of sleep, but she still feels sleepy during the day.

    - She has fallen asleep in movies, and even while standing up in front of her class at the whiteboard.

    - She isn't taking medication and doesn't show signs of depression.

- We need a sleep study to figure out what Izumi has. These can be very useful to diagnose sleep apnea, for instance, though in Izumi's case the sleep study confirmed something different: Izumi has narcolepsy.

- Narcolepsy is a chronic disorder that affects control of sleep wake cycles. People with narcolepsy have severe daytime sleepiness

and fatigue, and can have periods of involuntary sleep during the day that can occur at any time. They also may experience cataplexy (a sudden loss of muscle tone) and sleep paralysis (which occurs to everyone, but may be more disturbing and intense in people with narcolepsy).

- Izumi and her family are happy to learn that there's good medical therapy for narcolepsy. There's no cure, but daily stimulant medications can improve wakefulness and quality of life, and with monitoring she should be able to continue to do well in school, drive safely, and work in almost any occupation. Izumi will also need to follow some behavioral strategies, including good sleep and exercise habits, to get quality nighttime sleep and to minimize daytime tiredness.

- There are other medical problems that can interfere with good sleep:

  - Sleep apnea makes it difficult to breathe at night, and leads to multiple wakings per hour.

  - Restless legs syndrome causes pains or other sensations, especially in the legs, at bedtime. These sensations make people need to move their legs around, interfering with their own sleep and that of their spouse.

  - Many medicines can cause daytime sleepiness, too. Caffeine consumption can also interfere with good sleep.

Sig's Bedtime

- Our last patient today goes by the name Sig. He's 17 years old, and his mom's concern is that he just goes to sleep so late: 1:00 or 2:00 am. Sig says he can't help it—he's just not tired earlier. On weekends, it's not a problem—he sleeps until the afternoon. But on Monday morning, getting up for school is pretty much impossible.

- What Sig has is called a *delayed sleep phase* disorder. Basically, his circadian clock is out of whack. Internally, we all have a built-in clock that tells our body to do certain things at certain times—to sleep, at night, for instance.

- Sig has an idea: only taking afternoon classes when he goes off to college. That will help, in a way—allowing him to follow the rhythm his body seems to want to follow.

- But there are other things he could do that are probably a better idea. He should stay off caffeine, and try to get more exercise, especially in the morning. He should also avoid lights and lit screens in the evenings.

- His bedtime can be moved earlier night by night, but only by about 15 minutes a day, while gradually waking up earlier, too. The bedtime and wake times need to be kept consistent, every day including weekends, or the delayed sleep pattern will reappear.

Light from a cell phone may interfere with sleep, because it simulates daylight.

- Another part of therapy for delayed sleep phase is the use of bright lights upon awakening. These can help reset the body's clock. We suggest Sig get into bright sunlight as soon as he awakes, pushing that time earlier by 15 minutes every day.

Suggested Reading

Ferber, *Solve Your Child's Sleep Problems*.

Kansagra, *My Child Won't Sleep*.

Questions to Consider

1. Why do people need sleep?

2. Are there some steps that help with *any* sleep problem?

Lecture 14

Developmental Delay

In pediatrics, our patients grow and develop. We don't expect a teenager to be the size or shape of a five-year-old, and we also don't expect a six-month-old to go on dates or drive a car. Our "normal expectations" vary by age. Still, there's an expected progression of growth and skills as babies mature to children and then teens. There are many different kinds of skills to consider—social, motor, and communication skills, for instance—and for each one, there's a large range of normal at every age. For today's grand rounds, we're going to concentrate on a single child, named Casey. We'll follow along at several visits as he grows.

Newborn Casey

- We first meet Casey right after he's born, in the newborn nursery. He's a first child, and you had actually spoken with his mom a few months ago, when her obstetrician (OB) noted on an ultrasound that he had stopped growing well.

- Casey's poor growth during the pregnancy is called *intrauterine growth restriction*, or IUGR. There are three general causes to think about:

  - Maternal things, like poor health or nutrition, smoking, drug use, or alcohol

  - Placental factors, because the unborn baby depends on the placenta to deliver nutrients and oxygen

  - Something that affects the baby directly, like an intrauterine infection or a birth defect.

- With Casey, the third cause is most likely—we don't know of any placental or maternal issues.

- At birth, Casey was vigorous, strong, and pink, with normal Apgar scores. His birth weight was 5 pounds 1 ounce, which, like his length and head circumference, were small for his gestational age.

- Other than low blood sugar—fixed with added glucose in IV fluids—Casey did fine. He continued to nurse well. The family went home after the routine three-day stay in the hospital.

Casey at Two Months

- We'll skip ahead to the next time we see Casey, for his two-month routine visit. His mom says Casey gets quite fussy, especially after meals, and tends to spit up a lot. That seems to make him even more fussy. Sometimes he almost seems to gag when he's nursing, like he can't swallow fast enough.

- On the exam, Casey has been gaining weight and length and head circumference. He's still small, but he's tracking upwards as expected.

- Other findings from the exam:

  - He tends to hold his head turned to his left

  - His neck muscles are tighter on the left

  - His head is shaped a bit like a parallelogram, with the left side of the back of his head a little flatter, his left ear shifted forward, and the left side of his forehead shifted a little bit forward as well.

- The asymmetry of the head shape is called *plagiocephaly*, and it's usually caused by external pressure—by a baby lying in the same position too much. That's called *positional plagiocephaly*. Rarely, plagiocephaly can also be caused by problems with the bones

of the cranium, but that's not the case here—that parallelogram shape is only seen with positional plagiocephaly.

- Sometimes, as with Casey, the plagiocephaly is associated with *torticollis*, a muscle condition that causes a turn of the head in one direction.

- Plagiocephaly doesn't cause brain damage, and a mild degree of plagiocephaly will almost always get better on its own. But since Casey has some torticollis as well, we refer the family to a physical therapist to help with neck stretching exercises, and we review with his mom and dad ways to encourage him to change head positions and spend time on his tummy while he's awake.

- Let's go back to one other concern of his mom's: the spitting and fussiness. Both are fairly normal for babies. The co-incidence of spitting and fussiness in babies is so common that many of these babies are at least tried on a trial of a safe reflux medication, to at least see if it helps.

- If those medications don't help, they should be stopped, and we ought to look for other causes of fussiness. Casey's mom and dad would like to try medication, so we prescribe Zantac.

Casey at Six Months

- It's a few months later, and Casey has returned for his six-month visit. He's continued to grow well. His parents stopped the Zantac; it never seemed to make any difference. They just try to feed him slowly, and have learned that he settles down quickly when he's held warm and close.

- As always, you review his developmental progress—he started rolling from back to front right after two months, which is actually earlier than expected, and is now babbling a lot, and can bear his own weight when he stands. He's still in physical therapy, though. His parents say that the physical therapist feels his neck muscles are now fine, but the flattening of his head has gotten worse.

- Now, looking straight at him, you get a sense that his left forehead and left eye are pushed forward, as is his left ear and the left side of the back of his head. On your neurologic exam, you find that some primitive reflexes, like the Moro reflex (a tendency to overreact to stimuli), have persisted. Usually, they'd be gone by now.

- All of these findings—his intrauterine growth restriction, mild feeding problems, persistent primitive reflexes, and plagiocephaly—taken together, could indicate a problem with Casey's developing brain. Here are the measures we recommend for Casey:

    - Continuance of physical therapy, and referral to a speech therapist to help evaluate his his swallowing

- □ An appointment with therapists who can fashion a lightweight fiberglass helmet to help his head grow into a normal, round shape

- □ Age-appropriate developmental activities his parents can do, like reading together and playing games, to ensure that Casey's environment is rich in learning opportunities.

Casey at Nine Months

- Our next visit is at nine months. Casey's vision and hearing are normal, and he's now wearing a molding helmet to help with his head shape. He has met with the speech therapist, who feels there is some oral motor weakness. In fact, he hasn't done very well advancing into thicker foods or table foods yet.

- His Moro and other primitive reflexes have finally disappeared. But when you start your exam, his mom says, "I think he's a lefty—he uses his left hand more than his right, and when he crawls he mostly pushes with his left leg." His exam backs this up.

- He's too young to have a hand preference—signs of hand side preference usually don't appear until 12 or 18 months. He has oral motor problems, and this history of plagiocephaly from not moving his head. Your working diagnosis, is cerebral palsy, and it's time to talk with Casey's mom and dad about that.

- The main things you tell Casey's parents are that cerebral palsy is a condition caused by a problem in the brain, usually from very early in a baby's life, often from before they were even born. Sometimes there's a very specific diagnosis, like a stroke that occurred weeks before delivery; sometimes there was a specific thing that happened, like a period of low oxygen during delivery. And sometimes the brain just didn't develop right and we don't know why.

- The bottom line, though, is that some problem with the brain happened, which then causes problems with the control and use

of muscles. That's what the name means: *cerebral*, in the brain, and *palsy,* a muscle problem.

- The brain problem in cerebral palsy is not progressive—it will not get worse. This isn't a tumor or an ongoing infection. But the clinical manifestations, what we see in Casey, do change over time, because babies learn different things at different ages. There's a huge range of functional outcomes with CP—many kids do great with therapy, though others can have lingering deficits or other problems.

- Though by definition CP requires motor problems, many but not all children with CP also have other impairments, which can include *cognitive disabilities*. That's the term we use now for what used to be called *mental retardation*—that phrase has very much gone out of style. It can be hurtful, and it doesn't convey the wide range of abilities that kids like Casey can grow up to have.

- Casey, on an MRI, is found to have what's called *cortical dysplasia*—basically, altered development of the brain, which affected the left side more than the right. That explains his relative weakness in skills on his right side, since the right side of the body is controlled by motor cortex on the left side of the brain.

- It's a myth that cerebral palsy is usually the obstetrician's fault for not rushing a delivery, or mom's fault for something she did during the pregnancy. In most cases, and certainly with Casey, the brain problem that led to CP occurred very early, and really isn't anyone's fault.

Casey Going Forward

- Over the next several years Casey did well. He enrolled in a program called Early Intervention to help coordinate physical, speech, and occupational therapies. He walked late, not until age two, and at first he needed special orthotics to keep his feet in

the right position. He also had some issues with the clarity of his speech. He developed crossed eyes and had eye muscle surgery.

- At his five-year checkup, Casey introduces himself as CJ. He's got thick glasses, and it's not always easy to understand what he says, but he's happy to see you.

- CJ will start kindergarten soon. He'll spend some time in a special class with other kids with developmental challenges, and about half his day in a mainstream classroom. His physical and speech therapies will continue at school, and he's also excited to tell you he's going to start karate. His mom pantomimes a karate chop, and tells you that CJ has decided he wants to be a ninja.

- A quick note on monitoring development in children: There are different ways that development can stray from its expected course, and that can provide important clues.

    - Development can be *delayed*. Delays in multiple realms of development, say speech and motor, are of much more concern than delays in only one area.

    - Development can also *regress*—when children lose skills they used to have. Developmental regression is always of more immediate concern than delay, because at least sometimes regression can be caused by a specific medical problem that needs to be treated.

    - Casey had *developmental deviance*, or the appearance of some skills in the wrong order: Hand preference shouldn't be seen normally at nine months of age, and he also rolled over earlier than expected, probably because of an exaggerated primitive reflex.

- Jumping to five years later, CJ is 10 years old. He speaks clearly now, and he joined the swim team after he quit karate a few years ago. His grades are pretty good, though he's in special classes

to help him catch up in reading and math. Mom says, “He’s amazing—just look how far he’s come!” And you agree, and you tell mom that you’re looking forward to seeing just how far he’s going to go.

Suggested Reading

Dowling, *A Different Kind of Perfect*.

Miller, *Cerebral Palsy*.

Questions to Consider

1. Everyone develops skills at their own rate—so how do we know if a child is genuinely delayed?

2. What are the medical causes of developmental delay?

Lecture 15

Is This Child Normal?

In this this course, we've talked a lot about "normal." Normal vital signs reassure us against many serious diseases; normal growth means good nutrition and health; and normal development means that the brain is healthy and that a child is in a nurturing learning environment. But there are some grey zones to normal, too. For instance: A marathon runner might have a resting heart rate of 40, which is healthy for her yet low for almost all other healthy adults. Abnormal doesn't always mean unhealthy. Think about these differences—normal versus abnormal, and healthy versus unhealthy—as we visit this lecture's patient.

Meeting Chris

- Chris is a 16-year-old woman with a chief complaint of, "Ask her," meaning, "Ask my mom," who accompanied Chris to the visit. Chris is staring at the floor and doesn't look up at you when you come into the room. Talking with her and her mom reveals the following:
  - Chris says school "sucks" and has stopped going
  - Her mother found a joint in her bag
  - There is a good deal of tension between mother and daughter.
- You figure you're not going to get a whole lot more information from the two of them together in the same room, so you ask her mom to step outside, and tell her you'll come speak with her later. You reassure Chris that you just want to do an ordinary exam—she'll be keeping all of her clothes on, and she doesn't need to

put on a gown. Chris still looks angry as her mom gets her things together and leaves.

- About physical exams: As doctors, we really can get a better physical exam from an unclothed patient. But we have to balance that against our patient's understandable and normal desire for privacy. This is especially an issue for adolescent girls, who should not be examined unclothed alone in a room.

Chris One-on-One

- The hope here is that some privacy with mom out of the room will get you more of the story. But her one-word answers persist.

- Here's how her exam rounds out:

  - Her vital signs are normal, and her weight and height are around average.

  - She's dressed in stereotypically boy clothing, with a short hairstyle, and has no makeup or earrings.

  - She has what looks like a hand-made tattoo on her own left forearm. It looks like a bird, surrounded by flames.

- You recognize this as Fawkes, a creature from the Harry Potter series, which gets her to open up in conversation. After a while, you steer things back to school, and ask if you can try to guess what the problem is. She says yes.

- "Do you feel safe there?" you ask. You're thinking about Chris, and how she does talk and act a little differently from other kids, who may think she's abnormal. And she's dressed in a stereotypically boyish manner. That doesn't mean she's gay or transgender, but it might make her the target of further teasing.

- Chris says the teasing doesn't bother her. Bullying is a very serious problem, but let's take her at her word for now. She also says the joint isn't a big deal.

- Regarding school, and school refusal: Maybe Chris is depressed, or anxious about something other than bullying. You ask a few questions about that, leading to: "Are there some worries that have really gotten stuck in your head, like a worry you just can't deal with?"

- Chris's eyes get bigger, just for a second. Then she says, "No," and goes quiet again. You thank her for talking to her, then say you're going to speak with her mom.

- About teenagers and confidentiality: Many states have specific laws that protect teen privacy regarding many issues, like pregnancy or the evaluation and treatment of sexually transmitted diseases.

- It's also considered the best practice to keep everything a teen tells you private, unless they're planning to hurt themselves or others. Then, you have to intervene, even if it means breaking confidentiality. Chris hasn't said anything that we can't keep private.

Chris's Mom

- When we go speak with her mom, she says she really doesn't think Chris is doing drugs—that's just not the kind of thing she would do. But she's worried about school, so she went through Chris's school bag, and found that single joint wrapped in plastic.

- She also says for the last three months, even before school started, Chris has been spending a lot of time in the bathroom; her mom is unsure what's she's doing in there.

- There are no sounds (which might indicate vomiting, from an eating disorder) or smokey odors (which could indicate drug use). The only odor is one that smells like diarrhea.

- "Wait here," you tell her, and you head back to see Chris. She confirms she has diarrhea, and that is the reason she is avoiding school. You confirm it's OK to bring her mom in to talk about this, and do so.

The Runs

- Now you can focus on more specific questions, with Chris being more willing to talk with her issue out in the open. She says she has had diarrhea for at least four months. She hates the word *diarrhea*, so you agree to call it "the runs" from now on.

- There's never been blood, and it's not that painful, but she has it frequently and she's become afraid that she won't make it to the bathroom, especially at school. One other thing you learn: Two weeks before the diarrhea started, the family had gone on a vacation to Mexico.

- The most common cause of diarrhea is a viral infection. Occasionally, diarrhea can also be caused by a bacterial infection. But these kinds of infections are temporary, acute things—they don't fit what's been going on with Chris.

- For longer-term, chronic diarrhea, we have to think along the lines of a different list, including causes like:

    - Lactose intolerance (testable by stopping and re-starting dairy intake)

    - Irritable bowel syndrome, which is often accompanied by abdominal pain and cramping, and sometimes with alternating episodes of constipation

    - Many medications, especially some antibiotics—though Chris isn't on any meds

    - Celiac disease, an autoimmune-mediated intolerance to wheat.

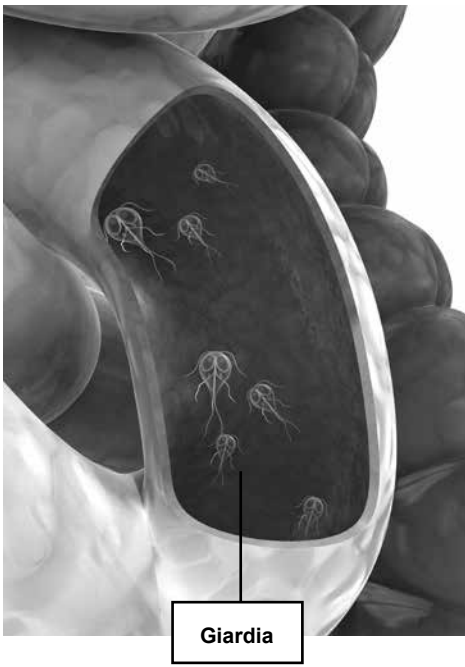
- With Chris's history we've got a good hint about something different that might be going on. On her trip to Mexico, could Chris have picked up some kind of infection?

- Since we'd like to make sure we're treating Chris the best way, we'll ask her to collect some stool in a container for the lab. It will be examined under a microscope, and other tests run, to identify an infection.

- You also prescribe an anti-parasitic oral medication to take twice a day for three days, and ask Chris to make a follow-up appointment in two weeks to come see you again.

- A few days later, you get the lab report: Chris's stool is positive for Giardia, a tiny microscopic protozoa, that's the most common intestinal parasitic infection seen in the U.S.

- Once identified, Giardia usually responds well to treatment, though sometimes a second course of therapy is needed. Occasionally the diarrhea persists for some time even after successful therapy.



Chris Going Forward

- After three days of her medication, Chris's diarrhea is gone. She goes back to school without a fuss and catches up easily. When she comes back to you for follow-up, she says, "I don't even know why I came back here, I'm better now."

- You tell her you're glad she's better, but you still had a few other things to talk about, starting with the joint. You talk together about the risks of marijuana as a gateway drug, and as something dangerous for girls, especially because if she's high she might do something or let someone else do something with her body that she doesn't want to happen. Regarding sex, she should decide for herself, not let drugs decide for her.

- You've also been wondering about the way Chris always dresses, broaching it this way: "I see a lot of teenagers, and you've got your own look."

- She says, "I know, I like to dress like this, I like to dress like a boy. But I'm not gay or anything like that." You make sure that Chris knows that you'll keep these conversations to yourself, though if she wants you to, you can tell her mom or dad things together when the time is right.

- To that you respond that it's OK to dress differently, and that she should be herself, but that sometimes that might mean other kids might pick on her or say mean things. She can come talk with you any time; you'll answer any questions, and you'll always be honest, and you'll never be mean. To that, she says, "You're good," which is quite the compliment from her.

- You've got some things to talk about with her mom, too. She says she's no longer worried about the drugs, and she feels bad that she looked through Chris's things and didn't trust her.

- You explain that snooping is sometimes necessary if a teen might be getting hurt or in trouble. This shouldn't be routine, though, and if you do have to do it, you ought to tell your teen that you're worried, and give him or her a chance to explain what's going on. Teens deserve a second chance, even if they've made a mistake or done something stupid.

Normal versus Abnormal

- Chris is on the autism spectrum, and has something called Asperger syndrome. Autism spectrum disorders, or ASDs, are very common, affecting about 1 in 68 people.

- That rate sounds very high, but keep in mind that it encompasses a very wide range of people with very varied manifestations. Milder forms, including Asperger, manifest by awkward social interactions and an unusual style of using language. We saw a lot of examples of that with Chris: her looking down at the floor, her sparse use of words, and her very direct manner of speech.

- It's fair to say that Chris's speech isn't very graceful, but it doesn't truly deserve to be called "abnormal."

- Additionally, Chris prefers to dress like a boy. She also said, "I'm not gay." These issues touch on another area that some would label as normal versus abnormal. We know that we're born with a biologic gender, defined by what genitalia look like—but sometimes even very young children identify themselves as the opposite sex.

- These individuals are called *transgender*. Children who are transgender, question their gender, or have a minority sexual orientation are very much at risk of bullying and social isolation, and have a high rate of suicide—and all of that is certainly unhealthy. These kids need our respect, protection, and love.

- Regarding the marijuana: Chris said that marijuana was, essentially, a normal part of teenage life. But marijuana is unhealthy for teenagers, who have developing brains.

- Regular use of marijuana creates irreversible biochemical and structural changes in the brain, affecting learning, memory, attention, and decision-making skills. Mental health issues like depression, anxiety, and psychosis become much more common in pot users, and there's growing evidence that heart and lung

disease can be related, too. Parents need to set a good example, and to let their teenagers know that pot will damage their brains and their bodies.

Suggested Reading

Centers for Disease Control, *CDC Health Information for International Travel 2016*.

Offitt, *Autism's False Prophets*.

Questions to Consider

1. What sorts of things would be very abnormal in adults, but are normal for children?

2. How do you know if a physical finding is genuinely abnormal versus unusual? Do abnormal things always imply pathology?

Lecture 16

International Adoption

Practicing good medicine means looking for clues. The stories of real people with real problems are far more complicated than the classic descriptions of illnesses in medical textbooks. To best help families, we have to unravel what's going on, which means paying attention and keeping track of a lot of information. In pediatrics, this can be especially difficult. Our younger patients don't talk, and can't tell us what's going on. We often have to rely on a history provided by another person, which means that the story is colored by the perceptions of someone else. The bottom line: Pay attention, and do the best you can with the clues you've got.

An Adoption

- Today's case involves a 15-month-old girl named Joy—or, to be accurate, that's her new name. Until a few days ago, she was living in China with the name Wang Jin.

- You first heard about Joy five months ago, when you sat down with an unmarried woman who wished to adopt Wang Jin; she was working with an agency to do so. Back then, we tried to get as much information as we could out of Wang Jin's somewhat sketchy records.

- As best as you could tell, Wang Jin was abandoned as a newborn, and her birth mother was unknown. She is described as bright and cheerful and inquisitive, though early notes also noted "extrapyramidal insufficiency" and a "crossing of the eyes." There was also a video of her sitting up and playing with toys.

- The comment that she had "extrapyramidal insufficiency" is a little hard to interpret—the phrase may be translated poorly, or perhaps

used in a different way by physicians overseas. In many cases, the phrase "extrapyramidal insufficiency" when applied to babies may actually just mean normal motor development for that age, as tremors and somewhat lacking motor control are normal for young babies.

- The video showed normal motor control of her arms and hands, and normal crawling. Seeing those advanced skills leads us to not worry so much about vague comments from when she was younger that concerned the extrapyramidal nervous system.

- The other specific finding mentioned in the report was the crossed eyes. The medical word for that is *strabismus*, and it's common, and almost always treatable. We do want to catch strabismus early. But a baby with crossed eyes adopted at a year or so should be able to have healthy, normal vision, unless there is a more significant generalized brain problem.

- We also talked with the mom about several other challenges the baby might face. Internationally adopted babies usually haven't been exposed to much English. Once they're here, typically their language skills pick up very quickly as long as there are no hearing or developmental problems.

- Joy might also be used to different food; it's best if mom plans a transition period before jumping to American-style feeding. There are also a number of medical screening tests that we'll want to get underway as soon as the baby arrives here.

Meeting Joy

- It's now about five months later, and we get our first chance to meet Joy in person. The chief complaint, voiced by her mom, is, "I think she's wonderful." Joy looks happy and bright. She's walking well for her age, too.

- New paperwork shows a few more sets of vaccines were given—she's missing just a few of the standard American vaccines, probably ones they don't routinely give in China.

- Her Mom brings up a few concerns: Joy's eyes sometimes cross inwards; she doesn't always seem to be listening; and occasionally there is blood in her urine.

- Babies like Joy, from an overseas orphanage, often face many problems:

    - We should assume that Joy's birth mother received no prenatal care, and that her delivery was not medically attended.

    - Some of these children have obvious health problems from birth—babies with cleft lip or other deformities may be more likely to be shunned and abandoned—and some were exposed to things like alcohol during pregnancy, putting them at risk for developmental problems.

    - Though many orphanages are well run and clean, overall there are certainly some health risks to expect, including issues from social neglect and poor nutrition.

- To address all of this in one first visit is impossible, so we'll focus on Joy's most immediate needs and schedule further visits to do a thorough job. To stay organized, let's start with a problem list:

    1. Crossed eyes

    2. A possible hearing problem

    3. Possible blood in urine

    4. Issues related to the pregnancy, her birth, and her past living situation in an orphanage in China.

Joy's Exam

- It's time for our exam. Joy looks vigorous and strong. Her vital signs are normal. Her eyes do cross inward, at least intermittently, but she can see fairly well—she's grasping for small objects, and

seems confident walking around in the strange exam room. Her ears, externally, look fine, but her eardrums with your otoscope look distorted and scarred.

- Several of her teeth look dark and unhealthy. There are many small lesions on her skin—they look like mosquito bites in different stages of healing—and there's a mark in the shape of a band just above her left ankle. This is called a *ligature mark*, and it means that at some time, and for at least several days or weeks, she probably had a loop tied there so she could be leashed down. Her genitals look normal, and otherwise we find nothing of concern on the exam.

- Overall, you get the impression that Joy is healthy and strong, though small. We have to expand the problem list, now—it seems Joy could have had multiple untreated ear infections, at least some of which probably perforated or burst her eardrums. That can cause scarring and decreased hearing. One part of the plan will be to refer Joy to an ENT specialist and audiologist for evaluation.

An example of strabismus

- We'll be referring Joy to an ophthalmologist, too. Joy's crossed eyes, her strabismus, needs to be addressed.

- Strabismus can be caused by problems with the eye muscles, the nerves that control those muscles, or a problem in the brain's visual control center. In the short term, strabismus means the eyes aren't working together, and the child can't see things with two eyes to appreciate normal depth perception. But in the long term, there's an even bigger issue down the road if strabismus isn't addressed. Children with uncorrected strabismus are at risk for developing what's called *lazy eye*, or *amblyopia*.

- If the eyes are crossed, the brain gets two misaligned images—it sees two different things from the two eyes. In time, the brain will learn to ignore one of the eyes. That means the part of the brain that's supposed to see out of the misaligned eye never develops normally, and vision from that eye can be permanently and sometimes severely impaired.

- Dental issues can be a problem for both American-born and internationally adopted children, too. Sometimes they've been fed at night by leaving a baby bottle in their mouths, and that along with other poor oral hygiene habits can contribute to tooth decay, like we saw in Joy. We'll refer her to a dentist for further evaluation.

- There was also mention of possibility of blood in the urine, or at least a red color in the front of the diaper, mom said just a little bit sometimes. We'll include a urinalysis in the screening labs we're going to arrange today, and do further workup at a follow-up visit later if we find abnormalities.

Screenings

- The State Department of the United States requires that internationally adopted children undergo a medical evaluation in their birth country, prior to getting a travel visa. However, this evaluation is sometimes done months before the child is adopted,

so it's recommended that a complete re-evaluation be undertaken within two weeks of a child's arrival here.

- Many of these screens are meant to pick up infections that remain common in other parts of the world, or are especially prevalent in children raised outside of a traditional family. Some of these are potentially contagious. We routinely test for:
  - Infectious hepatitis, HIV, and tuberculosis
  - Parasites
  - Lead level
  - Iron levels and blood disorders, tested with a complete blood count.
- Among the most important screens is an initial developmental assessment: How is the child doing in terms of communication, motor skills, and socialization?
- We order the tests for Joy, and plan to meet again in two weeks to review the screening tests and see what other questions have come up.

Two Weeks Later

- Joy's labs showed she carried two parasitic intestinal infections; both are treatable with oral medications—we had called that in to her pharmacy. The other blood tests were normal.
- She saw an ENT who documented mild hearing loss bilaterally, related to scarring in the middle ear; she'll be monitored to make sure that doesn't progress. Her ophthalmology appointment is next week. Today, we'll start catching her up on a few other needed vaccines.

- Joy eats ravenously and has begun to speak English. She has gained about half a pound in just two weeks, and her skin sores from the old bug bites are healing. Her mom is worried, though, about the red spots in her diaper, and the tests confirmed that there's a significant amount of blood in her urine. A urine culture was negative for infection.

- The medical word for blood in the urine is *hematuria*. With a urinalysis, we confirmed that Joy had significant hematuria, without other urine abnormalities. This can be caused by disease in the kidney itself, called *glomerolunephritis,* a kind of kidney inflammation that often also causes high blood pressure. Or, the blood can be coming from lower down in the urinary tract, from somewhere in the ureters, bladder, or urethra.

- In a person from overseas, one specific cause of hematuria is a chronic parasitic infection called *schistosomiasis*, which can invade the bladder—though this is not seen in the northern province of China, where Joy had lived.

- Knowing Joy was from China raised the specter of another health risk that can cause blood in the urine. In 2008, which is about when Joy came to our practice, a scandal erupted in China related to the contamination of milk with melamine, an industrial chemical.

- Melamine in the kidney can coalesce into crystals, damaging the kidneys and potentially growing into kidney stones. And that's what was discovered in Joy, on an abdominal ultrasound: multiple stones in both kidneys.

- Her kidney function, thankfully, was normal. A pediatric urologist was able to go through her urethra and bladder with an endoscope, leaving in a stent to hold the ureters wide open to allow the stones to pass. Still, if the stones had not been discovered, they could have caused a very painful and potentially catastrophic blockage of urine flow.

- We continued to follow Joy for several more visits. She ended up developing a series of ear infections, and ended up having tubes placed to prevent more infections and protect her hearing and language development. She also needed to wear glasses.

- By the time she was two years old, Joy was speaking clear English in two- to three- word sentences. She kept her inquisitive, outgoing personality. Her mom's first impression—that Joy was "wonderful"—turned out to be correct.

Suggested Reading

Custer, "Kidnapped and Sold."

Gaurendi, *Adoption*.

Questions to Consider

1. What sorts of challenges do adopted children face?

2. How can parents best prepare to adopt a child from overseas?

Lecture 17

The Tools of Discipline

A provider of pediatric medical care has to be good at helping parents manage behavior. Parents want our advice about sleeping problems and tantrums, helping siblings get along, and getting children to learn to clean up their rooms without a fuss. We also need to know when a behavior is a manifestation of mental illness or an important developmental problem. Helping parents overcome bad behavior when their kids are young can help set a pattern for success. When talking about behavioral challenges, it's best not just to address the specific question, but also to provide tools that parents can use for other situations. The specific challenges will change as kids grow and face new situations, but the basic tools of discipline remain the same.

Madeline's Lying

- Our first patient today is Madeline; she's three years old, and she came in today for what we've just diagnosed as an upper respiratory infection, or a common cold. We'd already given mom advice about how to handle that and what to expect, and we thought the visit was over—until mom brought up a new concern, sort of a second chief complaint: "What can I do about her lying?" Her mom says Madeline used to always tell the truth, but lately she has started lying about things. Is that normal? What can she do to stop it?

- Lying develops in normal children long before they've learned the moral axiom that lying is wrong. They don't do it to be evil. And there is a huge grey zone with lying that parents need to think about. We adults lie all the time: white lies to protect other's feelings, or lies to our children about whether we'll have cookies later.

If you catch your child in a misdeed, it's better to proceed with the punishment rather than question the child or try to trap her in a lie. Traps lead to a no-win situation for the child.

- Though lying isn't necessarily a terrible thing, and it's certainly developmentally normal, we do want to give Madeline's mom some guidance. She ought to praise her daughter for truthfulness, especially when she spontaneously fesses up to a misdeed. She also ought to model truthfulness, or at least explain to Madeline afterwards why she herself told a deliberate or accidental lie.

- In Madeline's case, we stress two tools of discipline. One is understanding the developmental stage of the child and how that contributed to the behavior. The other tool is modeling: Children learn a lot about how to behave by modeling—acting the way that they see their parents or siblings or classmates behave. Telling children how to behave isn't a bad idea, but showing them is even better, and more effective.

Owen's Disobedience

- Our second patient today is Owen. He's four, and his mom is concerned that, in her words, "He just doesn't listen." He won't pick up things from the floor when he's asked; he won't turn off his electronic game; and he won't start getting ready for bed.

- While his mom is telling you this, Owen is exploring the exam room, and at one point he climbs up on the chair. "You get off of there," the mom says, and Owen just keeps climbing. "See?" Mom says. "He just doesn't listen. Maybe he needs a hearing test."

- It's never a bad idea to do a hearing test—and if in fact Owen had poor hearing, we'd need to address that right away. But Owen's physical exam and hearing test turned out to be completely normal. There's another problem here, one that his mom can start to solve using two more tools of discipline: clarity and consistency.

- What you suggest is this: For a few weeks, she should really work on making sure that every command she gives, is very clear. Something like "Get off that chair" is clear, and it says exactly what is expected.

- She needs to go one step further: Beyond clarity, she has to consistently enforce these commands. When she says, "Get off that chair," and Owen doesn't do it, one second later she needs to pick him up and take him off the chair. This isn't to punish or hurt him, but to show him that once a command is uttered, it's going to be followed.

Alex's Sleeping

- Next up is Alex, a six-year-old boy. His dad says he's been sneaking into his mom's and dad's bed at 2:00 in the morning. He ends up sleeping between them, and habitually he sleeps sideways, which pushes his dad off the bed onto the floor. What can they do to keep Alex in his own bed?

- One tool that could be very helpful for Alex's family is positive reinforcement—giving a reward *after* a behavior to increase its frequency. A way to do that is with a star chart, or a sticker path.

- On a poster board, his dad draws out a pathway, breaking up the path into blocks by putting in sidewalk lines. He explains to Alex that every morning if he wakes up in his own bed, he'll get a sticker to put on the next block in the path. Every three or four days, a purple block signals a trip for ice cream, and every week or so, a blue block signals a purple dinosaur for Alex. The idea is that Alex intermittently gets an extra special reward, which behaviorally works even better than giving the same reward every day.

- Not all positive reinforcement needs to be a tangible prize. Hugs and cuddles work too, for some children better than prizes. And most positive reinforcement should just be sincere, specific praise, given right away: "That was great when you kissed grandma goodbye," or "I really liked it when you shared that game with your sister."

Alice's Temper

- Let's next meet Alice. She's 18 months old, and her parents are looking for help with two problems: hitting and temper tantrums. Avoidance, to some degree, is a legitimate and helpful tool here. If

her mom has found that Alice always starts to hit or has a tantrum when the family goes to a store and she doesn't get a new toy, then it's reasonable for the family to avoid taking her to the store for at least a little while.

- Still, avoidance alone isn't going to fix this—there's always something to frustrate an 18-month-old. In this case, for the hitting part, we're going to suggest a punishment as a tool to help.

- Punishment is a valid tool of discipline, but it shouldn't be the main tool parents use. Still, parents shouldn't be afraid of using punishment, at least once in a while, when it's the most effective tool for the occasion.

- The keys to using punishment as an effective tool are:

    - Use it infrequently, but consistently, for a single problematic behavior

    - Don't water the effect down with a lot of talking or explaining

    - Don't continue the punishment indefinitely.

- For Alice, timeouts may be effective as punishment. We suggest that every single time Alice hits, her mom or dad immediately starts the time-out process. It starts with her mom or dad showing an angry face, and saying, "No hitting." Then Alice should immediately be put into a timeout position, which is facing away from the parent. One way to do this is to sit down with the child sitting on your knee, facing away, being held under both arms.

- After about 30 seconds, she can be turned back around to face the parent, whose face should now have no anger. The parent should remind the child, in a loving voice, "no hitting," and the timeout ends. Keep this up for a week or so, every time Alice hits, and the behavior should cease.

- Again, punishment is one tool—Alice's parents should continue to use the others. They should model good behavior by not hitting each other, not even in jest; and they should offer specific positive reinforcement and praise when Alice doesn't hit.

- Alice's parents also need a plan to deal with the tantrums—and in this case, punishment is not going to work. Once a tantrum starts, a child is not going to learn anything from a consequence. If you can catch a tantrum before it starts, use distraction or humor, but don't give in to what the child wants.

- During a tantrum, it's best to keep your child safe and let the tantrum run its course. No hugs, no reassurance, and no talking—none of that will help, and these things, during tantrums, can perpetuate the behavior. Afterwards, tell her that you know it's not fun to lose control, and you're glad she's starting to feel better.

Molly's Intensity

- We have one more child to see today, Molly. She is three years old, and the chief complaint from her mom is: "I don't know what to do with her anymore." Molly is a high-intensity child. She went through a long hitting phase and was kicked out of two day cares. She can also be very willful and stubborn. Developmentally, she's been quite precocious, having talked early, and she's even reading now.

- Molly had been doing well enough in her newest day care, but ever since her new baby sister came home last month, she's back to hitting and yelling. Positive reinforcers, modeling, and punishment haven't worked on her.

- We need to step back a second with this case. Healthy kids need healthy parents, and it would be a good idea to talk with Molly's mom for a few minutes and screen her for postpartum depression. She had a baby a month ago, so this is a vulnerable time. We'll also ask about her husband and other family that's nearby that can possibly give her a break sometimes.

- Returning to Molly, we're going to suggest Molly's mom another tool of discipline: love. It sounds like Molly is always in the doghouse—her mom has said, "She's always bad" and "We're always yelling at her." The first step will be to turn that around.

- We suggest a specific plan we call "Molly time." For 15 minutes every day, Molly needs to get her Molly time—15 minutes, alone with mom, with the two of them engaged and doing something together like playing or working on a puzzle. Screen time is not allowed. It's all Molly, for 15 minutes, every single day.

- There are rules Molly's mom must follow during Molly time:

    1. No negative comments of any kind.

    2. Molly time must begin with an excited announcement: "It's time for Molly time!"

    3. During Molly time, mother and child must stay engaged, leaning towards each other, doing something truly together.

    4. Molly time can never be used as a punishment or a reward.

    5. Molly time has to end after 15 minutes. They can continue playing together, but it's best to change activities a little, and show with body language that the special Molly time has ended.

- The postpartum depression screening questions were mostly negative, but you want to keep an eye on mom and Molly both, so you request a follow-up in two weeks. In that follow-up, you can introduce some of the other tools of discipline we've been talking about. Molly time will help, but it sounds like this family is going to need more tools to help teach Molly how to behave.

Suggested Reading

Benaroch, *Solving Health and Behavioral Problems from Birth Through Preschool*.

Questions to Consider

1. Why would parents say time-out never works?

2. Who should parents turn to for advice if they're concerned about their children's behavior?

Lecture 18

Psychiatry in Pediatrics

Understanding psychology—the study of the mind—is essential to good pediatric care. Almost any symptom can be affected by the connection between mind and body. We always have to be mindful of the way psychological factors can influence the presentation of a medical problem, but also how medical problems can lead to psychological symptoms. The dichotomy between medical and psychological problems can be useful for diagnosticians, because it can remind us to think about different kinds of diagnoses. But in real life, patients don't come labeled that way.

Meeting Ariel

- Ariel is a 14-year-old girl who's brought in by her mother with a chief complaint of, "Her depression is just getting worse." To better capture Ariel's story, we're going to go back and review some of her past visits with us over the years:
  - We first met Ariel when she was about four. She had a very hard time getting started in school, with prolonged separation anxiety. Things only got worse when her dad ran off.
  - In elementary school, we had suggested regular check-ins with the school counselor. This was very helpful for a few years.
  - But by fourth grade Ariel was having both headaches and bellyaches on many days, and often in the mornings before school she had to run to the bathroom. A thorough medical evaluation didn't reveal any abnormalities, and her mom and Ariel both agreed that school stress was making everything worse.

- Some positives: Ariel picked up gymnastics and loved it. Ariel's mom understood her well, and was able to offer her some flexibility to miss part days of school, while still encouraging her to make it in later when she felt better.

- Then came middle school. Ariel lost the connection to her elementary school counselor. Her anxiety intensified, and she had daily bellyaches and headaches and felt tired, she said, all the time—making it hard to continue gymnastics, which she now said she didn't want to do anymore.

- Ariel's grades started to slip, in part from missing classes, and in part because her anxiety was making it harder for her to concentrate even when she was in school. Her general health examination remained normal, and another set of screening lab tests didn't reveal any new medical problems. We talked with her mom about making a more formal diagnosis.

Making a Diagnosis

- In many ways, mental health disorders are really quite different from "typical" health problems. We don't have truly objective tests for them, and the manifestations of the same mental illness can vary.

- To help clinicians navigate these difficulties, we rely on the criteria from the *DSM*, or *Diagnostic and Statistical Manual of Mental Disorders*, published by the American Psychiatric Association.

- Per the *DSM*, Ariel is close but doesn't quite meet the diagnostic criteria for a generalized anxiety disorder or depression. Still, she's suffering, and she's becoming less and less functional. Despite the lack of diagnostic clarity, we encouraged her mom to begin formal sessions with a psychotherapist.

- Still, after a few months in therapy, it was clear that Ariel wasn't making much progress. Her mom said she was getting more discouraged and sad and withdrawn, and we referred her to a

psychiatrist who diagnosed depression. She was started on a medication called Zoloft.

- The Zoloft, combined with continued psychotherapy, did help. By the end of her first year in middle school, Ariel's grades had improved and she was making it to classes every day. Just as important, she had gotten back involved with gymnastics, and her mood was good.

- Ariel remained on this medication for the next few years. She also continued to see her therapist regularly, despite ever increasing medical bills that made this difficult for the family.

Back to the Present

- Back in the present day, Ariel has come in with her mother, who has given us the chief complaint of, "Her depression is just getting worse." She refuses to go to school and is irritable.

- There are no new medicines or new stressors in school. Her mom says she has no idea what has set Ariel back. When you talk with Ariel directly, she does come across as more angry than usual. Her answers are short and clipped and don't really give you much new information.

- You find out that she had been sick a few weeks ago, with cold symptoms, a headache, and a mild fever, which have since resolved. Her mom thinks that was the start of this worsening mood.

- Ariel's blood pressure is a little high for her age and size; her pulse is 88 beats per minute, and her temperature is 99.9 degrees. Ariel is surly and short with you throughout the exam.

- You ask to speak with Ariel privately, and her mom leaves the room. In response to questions, she says there's no bullying, drug use, sex, or relationship issues on her mind.

- So we haven't found much evidence of any new stressors. Perhaps her moodiness and irritability are part of her depression. And as people age, sometimes antidepressants stop working, or need a dose adjustment.

- You call her psychiatrist to fill him in on the encounter, and to suggest a visit within the next few days. You also tell her mom to call if something comes up. Still, you're not very satisfied with the encounter. There's something wrong here.

Ariel Goes Downhill

- Ariel's mom calls a few days later. She says Ariel keeps talking about death and about dead people—she hasn't threatened suicide, but she seems, all of a sudden, interested in talking about morbid things.

- She's also been sent to the principal's office for slapping another girl for what sounds like no reason at all. Her mom also tells you her voice just sounds different now—almost like she's pretending to be drunk.

- Rapid symptom changes like this are not typical of depression. The slurred speech could indicate she is taking some kind of drug, or maybe there's a problem with her muscles of speech, or of the brain centers that control speech.

- We ask her mom to bring Ariel to the emergency department, and call over to give them a heads up. The ED physician on duty will meet her first, but you plan to head over to see her yourself after the afternoon shift.

- When you get there, you learn that Ariel was very agitated and upset when she first came in. She may have been hallucinating, as well—her mom's not sure, but she thinks Ariel may have been swatting away imaginary bugs.

- Her vital signs showed a BP of 136/92—that's high, again—a pulse of 112, and a temperature of 96.1 degrees. This is sounding less and less like typical depression—and these abnormal vital signs are a clue that this might not be a psychiatric diagnosis at all.

- When you talk with Ariel, her attention keeps wandering—she seems to recognize you, and she'll start to talk, answering a question appropriately. But then it falls apart, and she trails off.

- One diagnostic idea is to consider if a medication is causing a patient's symptoms. She's on Zoloft. Rarely, Zoloft can cause a very serious potential side effect called *serotonin syndrome*, especially when combined with other medications.

- Serotonin syndrome can cause agitation, confusion, and high blood pressure, which Ariel has, and often twitching or tight muscles, shivering, or fevers, which Ariel doesn't. When severe, seizures and unconsciousness can occur. Though Ariel's symptoms don't fit serotonin syndrome exactly, it is a possibility.

- Blood tests are drawn, which are normal; and you put a call in to her psychiatrist for his input. Ariel becomes more and more sleepy in the emergency department, and she is sent for an MRI scan of the brain. The scan shows just subtle abnormalities, with some increased brightness near the temporal lobe. The radiologist says this is suggestive of a brain infection called *encephalitis*, caused by perhaps herpes simplex virus.

- Ariel is admitted to the ICU because she's having periods of agitation and then sleepiness that would be difficult to monitor on the regular medical unit. A spinal tap shows very mildly increased white cells indicative of some inflammation.

- A rapid test called a PCR for herpes simplex on the spinal fluid is negative. Still, Ariel is started on intravenous medications to treat herpes simplex. Through the night she's noted to be persistently hypertensive, with mildly elevated BPs. Her temperature goes

up to 101 degrees, and she starts to have periods of clenching her jaw or moving it from side to side, along with twitches of the muscles around her eyes.

- Additional tests are sent for a variety of infections, including Lyme disease, West Nile virus, and rabies. The abnormal spinal tap and MRI weigh against serotonin syndrome, though further doses of Zoloft are withheld. The next morning, Ariel begins to have seizures that are difficult to control, and she's placed on a ventilator.

- The psychiatrist and neurologist raise a new diagnostic suspicion. They're impressed by the changes in mood and attention and personality; none of these are characteristic of a viral encephalitis like herpes simplex.

- An ultrasound is performed of Ariel's pelvis—which finally suggests a specific diagnosis. Ariel is found to have a left ovarian cyst, which upon surgical removal is found to be a benign teratoma. This kind of mass is sometimes associated with a clinical picture like Ariel's, an encephalitis that was only first described in 2005.

- Ariel's diagnosis is anti-NMDA receptor antibody encephalitis—the NMDA stands for n-methyl-D-aspartate. This is now recognized as one of the most common causes of encephalitis, especially in young people.

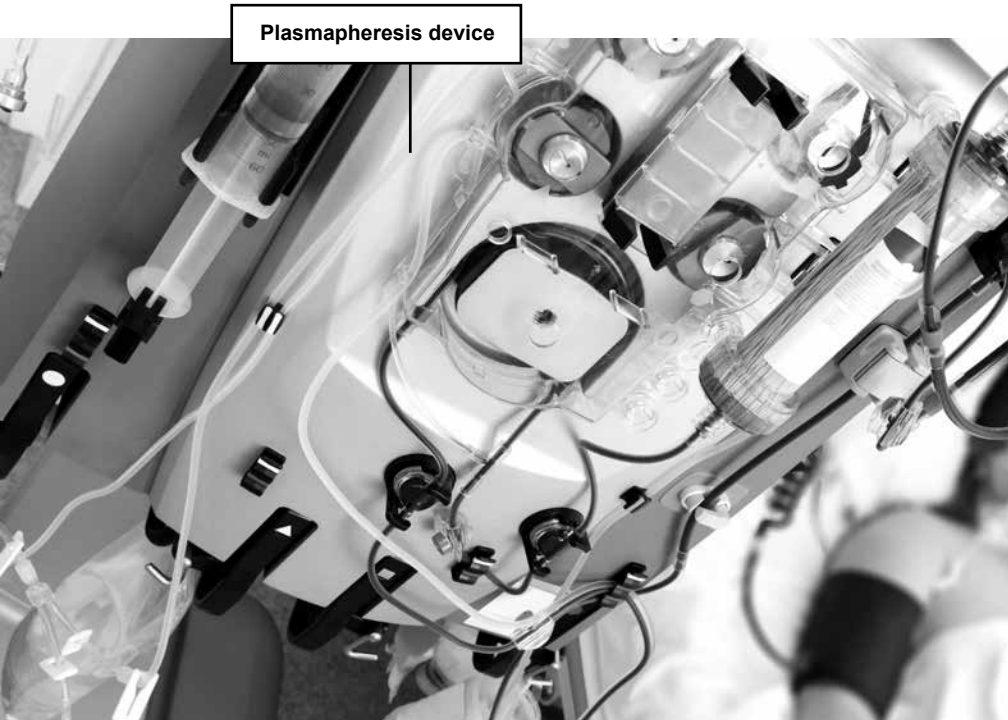
- Anti-NMDA is an autoimmune disorder, when the body starts making antibodies that attach to a specific receptor in the brain. The NMDA receptors in the central nervous system play a crucial role in the transmission of nerve impulses, including those that affect memory and behavior. Some ovarian teratomas, and sometimes other tumors, appear to stimulate the production of anti-NMDA receptor antibodies within the tumor tissue and in the brain itself. These attach and block the receptors on the nerves in the brain.

- Symptoms can include rapid temperature changes, a high blood pressure, speech and memory disturbances, a decreased level of consciousness, seizures, and movement disorders, often culminating in coma. The clinical decline, as in Ariel's case, can be quite rapid.

Ariel Going Forward

- If an ovarian mass is present, it should be surgically removed, and Ariel had that done a few days after admission. Additional treatments often include immune-modulating medications or other therapies used in autoimmune disorders, like intravenous immunoglobulins to bind up and deactivate circulating anti-NMDA receptor antibodies. A procedure called *plasmapheresis* can be employed to filter antibodies out of the patient's blood.

- Though it's not clear what the most effective treatment is, we do know that early therapy does help. About 80% of patients with anti-NMDA receptor encephalitis recover after several months, and the



chance of full recovery is improved if the diagnosis is made rapidly and aggressive treatment begun.

- Ariel, after a rocky start, did well. She stayed in the ICU for a week, then on the regular medical unit for another week, and spent two weeks in an inpatient rehab center. By the time of discharge her personality was back to baseline, though she still had somewhat slurred speech and was having some trouble with swallowing. Still, she had made great strides, and seemed genuinely happy to be going home.

Suggested Reading

Burns, *Feeling Good*.

Sacks, *The Man Who Mistook His Wife For a Hat*.

Questions to Consider

1. How can you tell if a symptom is caused by something physical versus something in the mind?

2. Are symptoms caused by stress "real?"

Lecture 19

Scratching for Clues

In every branch of medicine, adult and pediatric, the history drives the diagnosis. The clues that the patient or the family tells us along with the clues we discover by asking the right questions are our most valuable tools. If we rush, we're more likely to miss clues, misinterpret clues, or fall into the trap of following a false lead. Not every encounter needs to take an hour. But if something isn't going as expected, we're going to need to take our time to do a more careful job.

Meeting Kyle

- Our patient today is Kyle; he's 16 years old, and he's here with a chief complaint of, "lump in neck." He's been coming to this practice for years, and he's alone in the exam room—no parent.

- Kyle is a minor. It's not that uncommon for older kids to come in alone, or sometimes with a sibling—and in most situations, that's fine. We already have a general consent for treatment signed in the paperwork his family filled out when he joined the practice.

- We wouldn't want to perform any invasive procedures or make long-term or significant health decisions without an adult, but for many ordinary problems, a solo 16-year-old visit is OK.

- You say to Kyle, "Did you drive? You have your license already?"

- Kyle says, "No, but it's OK." He also says he "mostly" makes it to school OK. Later, it's revealed these were clues.

- His neck has had the lump for about a week; he thinks it's getting bigger. He sometimes has a sore throat and fatigue, and he thinks

he might have had a fever too. Kyle doesn't have any important past medical history, and is taking no medications. He's allergic to penicillin.

- On your exam, Kyle looks healthy. His clothes, though, are tattered and worn, and not especially clean. He has a mass about the size of an olive just underneath the angle of his jaw, on the right. It's not tender to touch.

- You tell Kyle that this is a lymph node. A swollen lymph node is usually caused by a mild infection, and in fact it's a good sign—it's your normal immune cells, the lymph tissue, proliferating to help fight infections.

- In children, swollen lymph nodes are found very commonly—far more commonly than in adults. In a child, a swollen node is almost always a benign thing, from a mild infection; in an adult, a significantly swollen lymph node is more often the first sign of cancer.

- Some possible causes for Kyle's swollen lymph node are:

  - An innocuous virus during an ordinary upper respiratory infection.

  - Strep throat.

  - Epstein-Barr virus, causing what's called *infectious mononucleosis*. Teens with this feel tired and sick, with sore throats, fevers, and sometimes dramatically swollen lymph nodes in their necks. But Kyle really doesn't look that bad.

  - An acute bacterial infection of the lymph node, called *acute* or *suppurative lymphadenitis*. *Suppurative*, here, means "containing pus," and *lymphadenitis* means "inflammation of a lymph node." Kyle's presentation, though, wasn't really acute—this developed over a week, not just a day or two—

and he doesn't have the telltale signs of a local infection, like tenderness, warmth, or redness.

- With one node that's not very big in a teenager who feels well, it's probably a mild virus, and the best thing to do is wait and see. You ask Kyle to call in a week if it's not better, and to come back to the office sooner if he starts feeling sick. You also offer to call his mom on the phone, so she knows what you discussed.

- "That's OK," says Kyle. "I'll tell her." He shakes your hand, and he leaves.

Three Days Later

- Three days later, you get a message from your nurse that she was unable to inform Kyle of his negative strep culture: His phone was disconnected. Since the test result was negative, you don't really have to talk to Kyle. Still, your uneasiness is growing. He seemed quick to not have you call his mom, and now you can't get in touch with him.

- Further attempts to track him down reveal:

    - His emergency contact was actually his family's landlord, who says they disappeared and skipped out on rent.

    - His guidance counselor at school says he stopped showing up for school about two months ago, and they have not been able to reach his family at all.

- The guidance counselor tells you his grades fell, he missed a lot of class, and he would wear the same clothes day after day. The school had reported this to child protective services, but since Kyle was 16 years old he is not considered truant. He can, legally, drop out of school.

- At this point you're worried that Kyle has no home. He is still a minor, and as a health-care professional you are legally obligated

to report a suspicion of abuse or neglect. After some more phone calls, the state child protective services agency opens a file, but they say they don't have the resources to track Kyle down.

Kyle Returns

- The next day, Kyle calls on the telephone. He says he feels worse; he's sure he's having fevers now, and the lump is bigger. You advise him to seek medical care right away, either in your office or the emergency department, but he doesn't come in until two days later.

- He apologizes, and says he couldn't get a ride. Kyle looks about the same—he's still wearing the same clothes. Today, he has a temperature of 100.7 degrees, and the enlarged lymph node under his right jawline is a little bigger, and a little bit tender to touch. It's now been there for about two weeks.

- Before asking more medical questions, you sit down to talk with Kyle about how he's been living. He's homeless, you learn—his mom found a place in a women's shelter, but he's not allowed to stay there overnight. He admits he stopped going to school. He denies drugs or alcohol, though he says that sometimes men pick him up and give him a drink, a meal, and a warm place to stay.

- He refuses an offer to help by calling the state for emergency foster placement, saying he needs to take care of his mom. But he agrees to wait while your staff places some calls to find different temporary housing and gathers clothing for him.

- The swollen node is still an important medical issue: In light of Kyle's homelessness, we've got a very different differential diagnosis to think about. Infections still lead the possibilities, but this time we'll want to cast a much wider net, because of the far greater likelihood of an exposure to a wide number of infections.

- A good mnemonic device for infectious exposures is the 5 Ps:
  - Produce: This means vegetables and other foods. Most food-borne illnesses cause GI symptoms, like vomiting and diarrhea, which Kyle hasn't had.
  - Places: Having spent time in a homeless shelter is a potential exposure source for many infections. As far as we know, Kyle hasn't had this kind of exposure, but it won't hurt to ask him again.
  - Pets and Pests: We wouldn't think Kyle would have a pet, but when we ask, we learn that he sometimes shares the lobby of the homeless shelter with a family of stray cats. Two infections we have to think about, related to cats, would be toxoplasmosis and cat-scratch fever. Toxoplasmosis is an infection caused by a parasite that is often found in cat

feces. Cat-scratch infections will usually resolve on their own, without antibiotics, in a person with a normal immune system.

- People: We need to think about sexually transmitted diseases, potentially in almost any teenager—but Kyle is at especially high risk. He admitted that he's sometimes picked up by men for drinks and a warm place to stay, and though we haven't pressured him for more information, it may be that he's trading for sex.

- Kyle is at high risk for HIV infection. When HIV first infects someone, there is often a non-specific illness that occurs about two to four weeks after transmission. This so-called acute HIV syndrome can seem like many other viral illnesses, with fevers, a sore throat, swollen lymph nodes, and achiness; sometimes there are GI symptoms, too, or a rash.

- Kyle is also at risk for other sexually transmitted diseases, including hepatitis B, hepatitis C and syphilis, which can also cause enlarged lymph nodes, among other symptoms. We've got a long list here of potential infectious illness, and since we're worried that Kyle might not have the best follow-up, we're going to test today for all of the ones we've mentioned.

- We also need to talk with Kyle about the health risks he's facing—to warn him against getting involved with trading for sex, though in his position he may not see many good alternatives. He needs a reliable, clean place to stay, with regular meals and bathrooms and shower facilities; he needs to feel safe, and we'd like to get him back in school.

- One of our nurses has gotten in touch with a church-based charity that's offered Kyle a place to stay—though he'll have to start applying for jobs, or return to school, and he agrees that he can do that. They'll also assign a social worker to help keep an eye

on him, and they've offered to see if they can arrange for drug treatment for his mother, and perhaps a place to stay for her, too.

Kyle's Diagnosis

- When his labs come back, Kyle has elevated titers against the bacteria *Bartonella henselae*, the cause of cat-scratch disease. A titer is the measurement of the amount of antibody in the serum; an elevated titer means there's been an exposure to an infectious organism, and a resulting rise in the immune system's antibody response. Thankfully, all of his other tests for infection are negative or normal.

- Over the phone next week, when you get the result, Kyle says he's feeling better and the lymph node is smaller. You see him once more in the office, and he looks better groomed and dressed, and his fever is gone. Cat-scratch infections will usually resolve on their own, without antibiotics, as it did in this case.

- Kyle is still at risk—not just for the infections we've talked about, but for the long-term effects of his social situation. A growing body of research is now concentrating on what's become known as toxic stress—stress that's different from the ordinary stress of childhood. This is stress that leads to a permanently increased risk of ill health through the rest of an individual's life. Children who experience toxic stress have an increased long-term risk of depression, heart disease, drug abuse, suicide, and early death.

- The most important protective effect against toxic stress is the protection of a loving adult. Situations like parental depression or other mental illness, abuse, drug addiction, and homelessness seem to be especially problematic, and these are compounded by poverty and a lack of wider social support. Hopefully we plugged Kyle into a support system early enough to help.

Suggested Reading

Centers for Disease Control and Prevention, *Bartonella Infection*.

http://www.cdc.gov/bartonella/

Ryan and Kelley, *Almost Home*.

Questions to Consider

1. Where do people catch infections?

2. What is the purpose of lymph nodes?

Lecture 20

Common Symptoms, Uncommon Diagnoses

Zebras, in medicine, are the oddball diagnoses—the things you might see once or twice in your career. The term comes from the axiom, "When you hear hoof beats, think horses, not zebras." But as the cases in this lecture show, sometimes zebras do show up. And if we keep our eyes peeled, paying attention to clues, we're likely to spot the zebras. In this lecture, we're going to meet several patients who come into our office with ordinary symptoms but end up with uncommon diagnoses.

Mabel's Nose

- Our first patient is Mabel, a three-year-old girl with a chief complaint from her mom of, "I guess she has a cold." A cold, more formally called an *upper respiratory infection*, includes a group of symptoms that are by far the most common driver of pediatric office visits:
  - A vague feeling of un-wellness, called a *prodrome*
  - A sore throat, and sometimes fever
  - A runny or stuffy nose, often with a cough.
- Mabel is missing the fever and sore throat. Still, a viral upper respiratory infection sounds like a likely possibility here. Allergies are on the table, too. Let's see what the exam shows.
- Her exam is normal. She's dripping a yellow-green liquid from her left nostril. The only other thing that stands out is an odor coming

from her. The dripping only coming from the left doesn't make sense: Cold viruses invade the whole lining of your nose, not just one side. And, besides, what is that smell?

- Remember, Mabel is three. And what do three-year-olds do, sometimes? You ask Mabel, "What did you stick up your nose?"

- She says, "A pea." Further questioning reveals it was actually three dried peas. In doctor lingo we'd call the peas a *foreign object*. The clues, here, were that the symptoms weren't entirely consistent with an ordinary cold. And the exam, though brief, showed a drippy nose only out of one nostril.

- The unpleasant odor was a bonus clue—a foreign body in the nose traps anaerobic bacteria, and those create a unique and unpleasant odor when allowed to grow unchecked.

- The cure, here, was quick—a few drops of a nasal decongestant were squirted into Mabel's nose, and a few minutes later you had her blow her nose out, hard. Out came a few green blobs of what used to be dried peas. The final step is to warn Mabel against sticking peas up her nose.

Peter's Vomiting

- Our next case is Peter; he's 18 months old, and the chief complaint is "vomiting." At 4:00 am he woke up fussing, and then vomited. He's thrown up two more times since then. It's now noon; he has refused to take any fluids, he's not wetting his diaper, and he didn't seem as active as usual.

- Peter's vital signs include a heart rate of 202 and a temperature of 98.3 degrees; his respirations and blood pressure are normal. That heart rate is quite fast; he also has delayed capillary refill, and he's not acting well. Clinically, he is in what we call *shock*, which means that his body isn't receiving an adequate supply of blood.

- We're in our pediatric office, but right across the street is a children's hospital, with a dedicated pediatric emergency room—that's the best place for Peter, and we arrange transport. There, blood is drawn for tests and he's started on IV fluids for dehydration. We'll check back on him later.

Crystal's Sores

- Meanwhile, we've got another patient to see. This is Crystal, she's 17 years old, and she's back to see us again with a chief complaint of, "These sores on my legs." She first came in about two months ago, with weepy red sores on both legs, starting below the knees. The diagnosis, then, was impetigo, a superficial skin infection usually caused by staph.

- She was treated with a topical antibiotic cream, then an oral antibiotic; neither worked. A culture of the lesions came back as negative—there were no bacteria at all. The sores are still around today. When in doubt, review the history: She hasn't been in dirty water, or anything like a hot tub where bacteria may be. She also replaced all of her razors.

- But her toenails look like they were probably painted at a professional salon. Crystal says she gets them done at a place near her school—and then, when you ask, you find out that she started going there about a month before the sores started.

- Could there be a connection here? You become even more convinced over the next few weeks when you encounter three more patients, all young women, all with persistent sores on their legs, and all of whom have been visiting the same nail salon.

- This case is modeled after a report published in the *New England Journal of Medicine* in 2002. The case involved four patients who went to the same foot salon, where they encountered an unusual bacteria called *Mycobacterium fortuitum,* a cousin of tuberculosis that doesn't grow in ordinary bacterial cultures. All of the women did recover, though their infections took a long time to resolve.

- The lesson here: When the sores didn't heal and the cultures came back negative, it was time to think again.

Returning to Peter

- Let's check in on Peter, our 18-month-old patient we sent to the emergency department for IV fluids. The nurse there reports he's stable, with a heart rate of 200 and otherwise normal vitals. He's still not very active, she says, but he's smiling some and seems better.

- He has received several boluses (relatively fast infusions) of IV fluids. Something here is wrong. If the fast heart rate and other findings of shock were all caused by dehydration, why is his heart rate still so fast after he's received IV fluids, and why hasn't he perked up? And, thinking back, how did he get so dehydrated, anyway? He only threw up three times.

- In this case, we're worried most about something called *cardiogenic shock*. That's when the heart can't pump blood effectively. The clue, here, was that fast heart rate.

- Peter turned out to have an *arrhythmia*, a primary disturbance in his heart rhythm, that was causing an overly fast heart rate. His timer was off, and it was forcing his heart to beat so fast that it didn't have time to refill completely—so even though his heart was beating fast, it wasn't beating effectively. One symptom of this kind of fast heart rate, or *tachyarrhythmia*, is vomiting.

- The lesson: Watch how a patient's story changes, or evolves, with therapy. Peter ended up doing well—he was transferred to a cardiac care unit, and medications were used to control his overly fast heart rate. Eventually a procedure was done in a catheter lab for a more permanent fix. On follow-up, Peter's heart rhythm remained normal, and he should continue to do well without needing further special cardiac care.

Vipul's Nosebleed

- Our next case today is another preschooler, a three-year-old named Vipul. He was brought in by his father with a chief complaint of "nosebleed."

- Nosebleeds, like our other chief complaints today, are a very common pediatric symptom. The most common cause in pediatric care is what we'll euphemistically call *digital trauma*, or nose picking. Other children have nosebleeds because of:

  - □ Blood vessels arranged very near the surface of the nose's lining, which can easily bleed
  - □ Minor trauma, like running into a door or falling down
  - □ Nasal allergies
  - □ A tumor or an abnormality of the blood vessels (rarely)
  - □ A systemic bleeding disorder, like an inherited disease or an acute or new illness.

- From Vipul's family, we learn that he's never had bleeding like this before, he has no bleeding other than the nose, and there's no family history of bleeding. Vipul's exam is normal, save for one finding: little dots on the skin that are called *petechaie*. Those are caused by an inability of the blood to clot.

- He does have a small, nearly healed rat bite on his foot, which he sought treatment for two weeks ago. The rat bite occurred while the family was renovating the basement, but Vipul's dad says the rats are gone now. Rat bites can spread diseases; however, Vipul has no symptoms of them.

- Blood tests reveal that his PT, a test of the clotting system, is way off. Vipul seems to have acquired a disorder of something called the *clotting cascade*. Now the question becomes: Why?

- The differential diagnosis for this isn't long:

  - Vitamin K deficiency caused by medications or health problems. Vipul has neither of those potential causes.

  - Severe liver disease, which Vipul doesn't have.

  - Overwhelming infection or severe inflammation, which Vipul also doesn't have.

- Here's a question we ask his parents: Is anyone in the house taking warfarin, or any other blood-thinning medication? They say no, which rules out Vipul getting into someone's blood thinners.

- Then it clicks: the rats. You ask how the family got rid of them. Vipul's dad says, "We just got some poison and put it in the basement. But Vipul doesn't go down there anymore."

- His mom corrects him—she says he did go down there a few days ago, to help mom pick out colors for a new carpet. Now it makes sense: One of the most common active ingredients in rat poison

is warfarin—sometimes the same warfarin used as a medicine in people as a blood thinner, and sometimes a modified warfarin that has a very long half-life.

- A very small dose of warfarin, to a rat, will cause extensive internal bleeding and death in a few days. For Vipul, a small dose has led to some bleeding, though he'll probably be fine in the long run. A larger dose, or even a small dose followed by minor head or belly trauma, could have been catastrophic.

- We call a pediatric hematologist and the poison center for help. Vipul will be given several doses of vitamin K to rebuild his clotting factors, and will follow up with the hematologist for repeated testing. His dad promises to head down to the basement to clean up any rat poison that's left.

Tonya's Rash

- Tonya is our next patient today; she's 17. Her chief complaint, delivered in greeting form, is, "It sucks my boyfriend is in Europe and I have this creepy rash. Hi doc, how have you been?" Her boyfriend is studying abroad in Spain and she really wants to go there. She talks to him, she says, all the time.

- Regarding her rash: On top of both thighs there's a reddish-brown discoloration, in a reticular, or net-like, pattern. It doesn't hurt or itch. She brings up her boyfriend again.

- The clue is already there. You ask Tonya how she's speaking to her boyfriend; she says Skype. Her rash is about where she'd balance a laptop across her legs.

- You explain that Tonya has a rash called *Erythema ab Igne*, which translates to "redness by fire." It's caused by a chronic, low-level exposure to heat or infrared radiation, too low to cause burning, but enough to slowly cause skin discoloration that can vary from red to brown, or sometimes even purplish or blue.

- Laptops, heating pads, heated car seats, and similar devices can do it. It's occasionally seen as an occupational hazard for bakers, jewelers, or others who work around heat sources. All Tonya needs to do is put her computer on a desk instead of her lap, and the marks will fade away.

Suggested Reading

Groopman, *How Doctors Think*.

Wen and Kosowsky, *When Doctors Don't Listen*.

Questions to Consider

1. What are you more likely to see: a genuinely rare thing, or a common thing presenting in an uncommon fashion?

2. When should you think about uncommon diagnoses?

Lecture 21

Coping with Pediatric Tragedies

In general pediatrics, most of our patients are healthy and well, and even if they get sick, they recover and do fine. But not all of the time. Our tragedies aren't as common as those seen in adult medicine, but when they do happen it can be very painful for families, doctors, and our staff. Today's case is going to be a loss. There are important lessons in this lecture, but some may prefer not to read this, or at least you may want to be prepared for what's to come.

Abby's Exam

- Abby is our patient; she's about two hours old. She's a first child, and she was born after a normal, healthy pregnancy. Since her mom is older than 35, some additional screening tests were performed. Being older than 35 puts her mom in the category of *advanced maternal age*, which means that her chance of having a baby with certain birth defects is elevated.

- Thankfully, the additional screening was normal. It's important to be able to explain, though, that even if the screening tests were abnormal, that doesn't mean the child will definitely have a problem.

- Abby's mom went into labor as expected right near her due date, and about six hours later Abby was born. At birth, Abby was pink and vigorous, and had normal Apgar scores of 9 and 9, which are entirely reassuring. She nursed immediately after birth, and did just fine.

- Regarding Abby's first exam, there are a few specific things we want to focus on:

- The heart and lungs, to ensure that the baby has made a safe transition to life without an umbilical cord
- Birthmarks, asymmetries of her limbs, or jaundice
- Any problem with any organ or system we can examine.

- We don't find didn't find anything of concern on Abby's exam. She does have a very normal, common birthmark on her forehead, a pink area with the familiar name "angel kiss." These typically fade away over several months.

Abby's Parents

- We next head to her parents' room to congratulate the couple, let them know how great Abby is doing, and see what questions we can answer. It's a good idea to focus this visit on her mom: She has been through a lot—childbirth is painful and draining. She says she's fine, but tired and sore. You remind her that she should take her pain medicines.

- We talk about nursing, which is often the main question on parents' minds. At first, a normal healthy new mom has essentially no milk production—maybe 5 milliliters, a teaspoon, from both breasts combined. But even that little amount is important—it's loaded with infection-fighting cells, and gives the baby a little bit of sugar, too.

- Newborns, for the first day or two, typically don't need more than this tiny amount of what's called *colostrum*, the early milk that's available before the real, rich milk comes in. A mom's milk usually increases in supply starting at about 48 hours of life, and there's not much mom can do to make that happen faster.

- Parents usually don't need to give formula unless there's a medical issue going on, but giving formula is fine if a family wants to calm an impatient baby or wishes to bottle feed for another reason.

- In the newborn nursery, screening tests will be done for hearing loss, congenital heart diseases, and several metabolic and genetic illnesses including hypothyroidism, cystic fibrosis, and sickle cell anemia.

- Antibiotic eye ointment is administered once, shortly after birth. This is a simple and safe intervention to prevent infections. Babies are also given their first dose of their first vaccine, against hepatitis B. And one more thing: a vitamin K injection, which virtually eliminates the risk of what was once a common, hemorrhagic disease of the newborn.

Abby over the Next Month

- The next time we see Abby, she's five days old. Her weight—which dropped after birth, which is normal due to the low milk supply—is now heading in the right direction, up. We expect her to be back to birthweight by her two-week visit. Her skin color looks fine, and a thorough exam is normal.

- Her mom has a question: She had heard that she shouldn't eat certain things, or drink coffee, because she's nursing. There are some situations where you might want to look into the mom's diet, especially if there were blood in Abby's stool, or excessive, continuous fussiness. But for the most part, most nursing moms should eat what they like to eat, and not worry about whether baby might end up fussy.

- There are other routine visits, at two weeks and one month. Abby grows well. She mostly nurses, but the family had decided to give a bottle of formula at bedtime, and that's working well for them. We'll plan to see Abby again for her two-month visit.

Three Weeks Later

- A second warning: Something bad is about to happen. If that's going to upset you, now would be a good time to skip to the next lecture.

- Three weeks after you last saw Abby, you're called to the phone at work. An emergency physician is on the line. Those are the kinds of calls you pick up, right away.

- You're told that Abby was brought to the emergency department this morning, by ambulance. She was found cold and lifeless in her crib, and was pronounced dead upon arrival. The ED physician says she is very sorry. The parents are there in the ED, and they've asked for you.

- You hang up, and speak with your office manager. Cancel the rest of this morning's appointments, you tell her, and anyone already in the office can see one of the partners or reschedule. Please apologize to each of them, one by one, and make sure they know this was an emergency that could not wait.

- Driving to the hospital, you can't help wonder if you missed something. But there really was nothing—no clues, nothing abnormal, nothing that should have made you worry.

- When you get to the Emergency Department, you're told that Abby's parents are in a private room, with a nurse. Abby herself is in the trauma room, a room right next to the ambulance bay where the sickest patients are brought in quickly for care. You decide to visit Abby, first.

- In the trauma room, a baby wrapped in a blanket is lying on the table in the middle of the room. She's pale and not moving, and when you touch her, the skin is cold. The ED doctor follows you in, and after a moment of silence she says that's how Abby was found, cold and stiff, and that it was clear she had been dead for a while.

- No resuscitative effort was undertaken in the ED, which was appropriate—nothing could be done to restore life. The ED doc examined her carefully and found no evidence of any trauma or other problems; she's already contacted the medical examiner's

office and the hospital pathologist to collect specimens to help with the autopsy.

- Abby's parents have been quiet. So far they've only asked for you. They haven't come in to see Abby yet, so you request someone to sit in the room for a few minutes; you don't want the parents to see that Abby was left alone.

Abby's Parents

- It's time to go see Abby's parents. There isn't any one right way to do this—it's a very personal moment, and we're not all going to react the same way, and that's OK. It is a good idea to be able to sit with parents in a private space, certainly not in a hallway. It's also good to have another person there—perhaps a nurse, the ED doctor, or a pastor—for added support. Another family member is fine, too, though you don't want a room full of people.

- Abby's parents are sitting next to each other, just staring. You offer to shake hands, or you would have accepted a hug, but they just sit. You join them, and say how sorry you are. Mom asks, "How is she? How is Abby?"

- It's unclear what she meant—perhaps she knew Abby was dead, but she maybe needed to hear it from you. Or maybe she wanted to know how Abby felt. This isn't a time for euphemisms or to be vague, or to make assumptions about the parents' religious beliefs. You say, simply, that Abby is dead, and she didn't suffer. The most likely cause of death was SIDS, but you'll need to get more information, and you'll talk about that more, later.

- You ask about contacting other family, and get some names to call, and then offer to take them in to see Abby. "I think it's a good idea," you say, "but only if you want to. Many families find that seeing or holding their babies can help, though it can hurt more at first." When you visit with Abby, her dad holds her. You clip off some hair for them to keep, and you say goodbyes.

- You do need to collect some medical information, so you gently ask questions about how Abby had been doing and her sleeping habits. There need to be an autopsy and a death-scene investigation to see what more information can be learned.

- The parents are very cooperative. They say they want to know everything. The bottom line, after a thorough medical evaluation, is that no abnormalities or suggestive history was found—no cause can be determined for the death. Abby died of *sudden infant death syndrome*, or SIDS.

SIDS

- SIDS is the most common cause of death of infants from one month to one year of life. It's defined as an unknown—a death that, after a thorough investigation, still has no specific cause.

- Though we don't know the cause, we do know there are risk factors—things like having a baby put down to sleep on her tummy, or tobacco exposure, or sharing a bed with a baby. There are also protective factors, like breastfeeding and vaccinations, which lessen the risk of SIDS.

- Still, there are no guarantees. About 2,500 babies a year die of SIDS in the U.S.—about half of the rate in the 1980s, before the Back to Sleep Campaign, but still far too many.

- The best scientific evidence for the cause of SIDS is that it is a combination of three factors: First, a baby must have a genetic, or inborn, problem with the brain functioning that controls breathing and arousal. Second, the baby is at an age where protective brain centers—that parts that wake you or force you to turn your head when you're not breathing well—are immature. And three, an environmental stress occurs, like overheating or rebreathing exhaled air. If all three of these happen at the same time, SIDS becomes a threat.

- We currently don't have any way to test for vulnerability, though some promising research looking at brain serotonin functioning may give us the clues we need to be able to determine these risks.

- For now, the best steps are for parents to avoid the modifiable risk factors—though even then, as with Abby, there are times when SIDS seems to be unavoidable. Though you only knew her for a few months, Abby is a patient you are not going to forget.

Suggested Reading

Buckman, and Kason, *How to Break Bad News*.

Firstman and Talan, *The Death of Innocents*.

Questions to Consider

1. How can parents best keep their babies safe?

2. Does every death have a reason that we can identify and understand?

Lecture 22

The Girl Who Turned Yellow

Two letters commonly appear on every prescription: Rx. It's unclear whether this is a symbol or an abbreviation. The abbreviation theory holds that Rx is short for the Latin word *recipere*, meaning: "take this." An alternative theory is that the Rx is not two letters, but a symbol, with the tail of the R extended further, then crossed to become what looks like an x. This x symbol is representative of the Roman god Jupiter, and in this form it is essentially a prayer or invocation, asking Jupiter for help. In a way, then, Rx might mean, "Take this and pray." Usually the situation isn't that dire, but in this lecture we'll meet a patient where prescriptions and other factors lead to a complicated case.

Meeting Hailey

- Our patient today is a six-year-old girl, Hailey, with a chief complaint of painful urination. According to Hailey, this started last week, but her mom says it was actually yesterday. She also has to go to the bathroom a lot. There's been no fever, and Hailey has otherwise been well, with no important past medical history. She's taking no medications.

- Hailey's physical exam is normal. She's happy, with normal vital signs. Since she has discomfort when she urinates, you do a brief external genitourinary exam, which is normal. Of course, when you do this part of the exam, you tell Hailey that's OK for only the doctor to look there, and only if her mom is in the room. You do the exam with Hailey sitting in her mom's lap.

- Some possible causes for Hailey's painful, frequent urination are diabetes, a urinary tract infection, an external cause, and diabetes. The most common cause for Hailey's symptoms, though, is something parents don't think about much: Hailey could be holding it in at school to use her own bathroom at home.

- Habitually holding in urine can cause thickening of the bladder wall muscles, strengthening of the muscle that closes the urethra (which makes it unable to relax when needed), and changes in the brain that affect the bladder's ability to sense when it's full. All of this can cause painful urination and frequency from an inability to completely relax and empty the bladder.

- We talk with Hailey and her mom about trying to drink plenty of water, and visiting the bathroom at least every 60–90 minutes, to keep the bladder happy and empty. In just a few days, these new habits can start to reverse the physiologic changes and improve symptoms.

- Urine tests show an infection is likely; there are white blood cells and chemicals called *nitrites* in the urine on the quick dipstick test. That's not surprising. Another consequence of holding urine

is what's medically called *stasis*—the urine sits too long, which means it's prone to infection.

- Urinary tract infections come in two types. Hailey has a bladder infection and infection of the lower part of the urine-collecting system, which causes symptoms of pain and frequency. A more serious urinary tract infection involves the upper part of the system, including the kidneys, and also causes fever and back pain.

- Since Hailey overall isn't feeling that bad or acting sick, simple oral antibiotics should work well. We also remind her she has to drink plenty of water or juice—good advice for anyone with a urinary tract infection.

- One widely used antibiotic for this is Bactrim, but Hailey's chart says she is allergic to Bactrim, and her mom says she had a reaction to it in the past. Instead, we choose a different antibiotic: nitrofurantoin, which should work well for a urinary tract infection.

- A few days later, the urine culture results come back, confirming an infection with bacteria that's sensitive to the antibiotic we chose. A nurse calls the family; her mom confirms that Hailey is doing better, and we remind them to finish the antibiotics. A clean, simple case.

The Next Day

- Or so we thought. Hailey returns the next day with yellow eyes and skin. This is jaundice, which is caused by an elevated level of a blood chemical called *bilirubin*, which itself comes from the breakdown of hemoglobin (which comes from red blood cells dying naturally and breaking down) in the liver.

- Jaundice can occur for a just a few reasons. The liver itself could be sick. Or, it's possible that there's an excessive amount of hemoglobin being released, from too many red cells dying at once. The medical word for this is *hemolysis*.

- In Hailey, our first step will be to figure out if the main issue here is in the liver or the blood. She's had just a mild bellyache last night, which resolved—and no tenderness over her liver on exam. That goes against hepatitis. She's also not taking medicines that affect the liver, or drinking alcohol.

- One other symptom, though, does give us a clue: Hailey said her urine was dark. In this setting that could be from free hemoglobin, filtered by the kidneys from the blood into the urine. That dark urine is very suggestive of hemolysis, not liver disease. We'll do a few simple quick tests in the office to help confirm this.

- First, we double-check Hailey's vitals. They're fine, but her heart rate has climbed to 96. That's still normal, but higher than it was a few days ago. The rise in heart rate suggests a specific possibility: Hailey has become anemic, with too few red cells, which fits our suspicion of hemolysis.

- Some quick tests confirm this. Since she's also anemic, with a low hemoglobin concentration, we would call her clinical diagnosis *hemolytic anemia*.

- Now the question becomes: Why is Hailey having hemolysis? There are many inherited causes, two of which are sickle cell anemia and spherocytosis, which is a condition where red cells are more spherical than flattened.

- Hailey's newborn screen didn't show sickle cell anemia or any other altered hemoglobin, and included in her yearly checkups have been negative screening tests for anemia. An inherited process is unlikely, here.

- Instead, Hailey has an *acquired hemolytic anemia*—something new has changed, to cause her red cells to pop early. One common reason this happens is *autoimmune hemolytic anemia*—when the body makes antibodies that attach to red cells, causing

hemolysis. We'll need to test for this, but we can't do that kind of test in our office.

Medical World Problems

- You explain this to Hailey's mom. Hailey will need to have more blood tests drawn at the hospital, and with those results you'll get in touch with a hematologist. Her mom says, "It's not the sulfa, is it?"

- "What sulfa?" you ask.

- When she earlier reacted to Bactrim, her mom explains, she turned yellow and listless, and was hospitalized for three days. The antibiotic had been prescribed for impetigo, a superficial skin infection that's usually caused by *Staph aureus*. But after the reaction, she was told never to take Bactrim or any "sulfa antibiotic" ever again.

- This brings up a problem in the medical world: Naming conventions for medications are confusing. Every medicine has an official, chemical name, called the *generic name*. The generic name for what we've been calling Bactrim is trimethoprim-sulfamethoxazole.

- But the same drug was also marketed under the same Septra, and is sometimes also called co-trimoxazole. In this case, mom was also told to avoid so-called sulfa drugs, referring to the chemical class of medicines that Bactrim comes from. So, Bactrim, trimethoprim-sulfamethoxizole, Septra, co-trimoxazole, and sulfa all refer, essentially, to the same thing. It's a setup for many medical errors and misunderstandings.

- Here's another setup, which unfortunately caught Hailey this time: Hailey's past medical records included notes referring to her hospitalization, but they were handwritten and hard to read. The past records didn't include records directly from the hospital, which should have included a typed discharged summary. Perhaps, with clearer past medical records, this episode could have been avoided.

- Another factor: our sometimes-loose use of the word *allergy* to describe any adverse drug reaction. An allergic reaction is one kind of adverse reaction, when a medication interacts with the immune system to cause symptoms.

- Looking back, what Hailey had the first time was in reality probably not an allergic reaction. When she was 18 months old, she took Bactrim, and shortly thereafter developed a hemolytic anemia, with the destruction of red cells in her blood causing yellow skin and eyes and dark urine.

- That's exactly what's happening now, though this time she's not on Bactrim or any chemically similar medication. But that past episode was so similar, they've got to be related. How?

- Later on, you did get the detailed records from the prior hospitalization. You see that their workup for the hemolytic anemia included blood tests for immune conditions that could attack her red cells—those tests were negative. The final diagnosis, then, was hemolytic anemia trigged by Bactrim.

- The connection here is a subtle one: It's the two different drugs that each caused the same reaction. It's not allergic, in this case. This time, you suspect it's from a common inherited condition called *G6PD deficiency*.

- G6PD, short for glucose 6 phosphate dehydrogenase, is an enzyme found in red blood cells that protects the cells from damage. People who have a deficiency of this enzyme are prone to red blood cell destruction, especially triggered by infections or by certain medications—including sulfa-based drugs, like Bactrim, and also including nitrofurantoin. These, and several other medications, can trigger episodes of hemolysis.

- Looking back at those old records, her doctors at 18 months suspected G6PD deficiency as a possible cause, after that

episode following Bactrim. But her blood tests for the condition were normal.

- That's another lesson from this case: Every test has its limitations. The test for G6PD measures the enzyme level in red cells—but during an acute crisis, when a lot of the red cells are hemolyzing, the measurement can be normal. A retest after the crisis would have been ideal but fell through the cracks because of some miscommunication between the old doctor and Hailey's mom. And we should have dug deeper into the details of that prior hospitalization when the family transferred to our care.

Hailey's Outlook

- Hailey did well. Her anemia wasn't severe, though for a few days she had to put up with daily blood draws to make sure it didn't get worse. Nitrofurantoin was stopped, and another antibiotic was used to complete treatment for her urinary tract infection.

- Several months later, blood testing on her, her mom, and her brother confirmed they had G6PD deficiency. The family and their doctors now know to be careful with prescribing medicines that can trigger hemolysis.

- It's not only certain medications that can trigger problems in people with G6PD deficiency. Some foods can too, especially fresh fava beans or bitter melon. Overall, though, the most common cause of hemolytic episodes in people with G6PD deficiency are infections, including pneumonia, strep throat, or urinary tract infections.

- In fact, we don't actually know that it was the Bactrim that triggered Hailey's initial hemolytic episode at 18 months, or that nitrofurantoin triggered this event now. Maybe the medicines are the culprit, or maybe the infection is the trigger.

- There are lists of drugs that are safe or unsafe for people with G6PD deficiency, but often they're based on individual case

reports and may not be reliable. Those lists are a good place to start, though with any medicine we should be vigilant.

Suggested Reading

"Glucose-6-Phosphate Dehydrogenase (G6PD) Deficiency Clinical Presentation," http://emedicine.medscape.com/article/200390-overview.

Packard, *The Making of a Tropical Disease*.

Questions to Consider

1. How have infections affected the way humans have evolved?

2. Does the location of belly pain tell you a diagnosis?

Lecture 23

A Different Cause of Vomiting

To a pediatrician, vomit and other unpleasant things that come out of children are really no big deal. To our patients, though, nausea and vomiting are among the most unpleasant symptoms that they ever have to endure. In this lecture, we're going to meet a patient with both symptoms, but with an atypical cause. The lecture covers some ailments that can strike during childhood, such as appendicitis and the hepatitis viruses. We'll also see just how important vaccines are for preventing cases like this lecture's.

Meeting CT

- The patient today is a 12-year-old boy, named CT. You and his mom have had some long conversations over the years about a subject that's very important: vaccines. CT's mom, to summarize years of conversations, is leery of them, and her children are somewhat behind on them.

- Today, she has brought CT in with a chief complaint of "vomiting." He had been in good health until about three days ago, when he started to complain of nausea. He then lost his appetite. The next day he started vomiting, and later developed some abdominal pain. Since then he's continued both symptoms.

- The vast majority of children who have vomiting have an ordinary tummy bug, a brief viral gastroenteritis. The treatment includes mostly supportive care, with sips of fluids, and perhaps a medication to decrease nausea. The family should keep the child home and wash hands frequently, as this bug is contagious.

- But that doesn't quite fit CT: The illness hit after a full day of low appetite, rather than coming on quickly, and he's had no diarrhea.

CT's Clues

- CT's past history includes some trouble he's had in school over the years, especially with reading. He's been diagnosed with dyslexia. His mom has also become concerned he could have ADHD, so she started him on an herbal supplement: Focastapin. We'll need to keep in mind the possibility that this supplement is related.

- On his exam, everything is normal. But when he lies down, he tells you that his belly hurts, pointing especially to the right upper quadrant—and when you palpate there, gently, it seems tender. His skin is not yellow, and there are no other findings on the exam.

- For physical exam clarity, the abdomen is sometimes divided into four quadrants, right or left plus upper or lower. The right upper quadrant, the location of CT's pain, is over CT's liver and gallbladder. But before we focus on that, we still need to think of the other right-sided abdominal pain: appendicitis.

- CT's symptoms don't quite fit appendicitis: The nature of the pain is a bit off. After three days of pain, an appendix should have perforated and led to fever and other symptoms, and in appendicitis, pain begins before vomiting, rather than the opposite. We can't completely rule out appendicitis, but it seems unlikely, and we can push that possibility to the back burner for now.

- The most common scenario causing vomiting and right upper quadrant pain in a child is acute hepatitis, or inflammation of the liver. Rarely, a liver abscess—a bacterial infection in the tissue of the liver—can present with somewhat similar symptoms, though more typically there would be fever and even more intense, persistent pain.

Acute Hepatitis

- To help guide our next steps, we need to think about the potential causes of acute hepatitis. The most common causes are infections, including the lettered hepatitis viruses A through

E. They were named by letters in the alphabet in the order of their discovery.

- Hepatitis D and E are both quite rare in the United States, and Hepatitis D only causes clinical infection when it's present along with a simultaneous infection with hepatitis B virus. Hepatitis C is only transmitted through blood. That means, in pediatrics, we see this infection in our patients either in young babies who picked up the infection during or shortly after birth, or in teenagers who engage in risky sexual or drug-taking behaviors.

- Like hepatitis C, hepatitis B is transmitted through blood, so perinatal and teenage exposures create the peak times of risk. But there is also an additional risk of transmission of hepatitis B in the period immediately after birth, either from the mom or from other close contacts. That's why universal vaccination is recommended for all newborns, to get the protection they need in place when they need it.

- Next up is hepatitis A, which is transmitted by contaminated food or water. In the past, hepatitis A vaccinations were recommended for international travelers and those in other high-risk groups. But in 2006 the recommendation was changed to include all children starting at age one.

- Other viruses can cause hepatitis, too, including especially Epstein-Barr virus, which we usually associate with mononucleosis. CT hasn't had the symptoms of mono, like fever and sore throat, but we'll keep the Epstein-Barr virus as a possibility since that virus is so common. There are a few other viral infections, and some rare bacterial infections, that can also cause acute hepatitis.

- Beyond infections, there are still other causes of acute hepatitis in children. One relates to the liver's function as a blood chemical processing facility. CT isn't taking any medicine, but he is taking that herbal supplement Focastapin. Most of these products belong

in the “probably safe” category, but some herbs, such as Kava, can cause significant liver damage.

- Hepatitis in children can also be triggered by an autoimmune condition, when the body’s immune system starts to attack the liver. And very rarely, hepatitis can be caused by an inborn metabolic disorder.

- Our next steps with CT are to narrow down this list. We send him for blood tests, including tests for liver cell damage, and tests to make sure that his liver is working well. We also order antibody tests for hepatitis A, B, C, and Epstein-Barr virus, and a liver and gallbladder ultrasound.

- Later that day we get some preliminary results back. The ultrasound is normal. Blood tests show striking elevations in what are called the liver enzymes. These tests go by the abbreviations AST and ALT. These are very elevated—normally, they’re around 30 or 40, but in CT they’re in the 2,000s. Blood tests also show some elevated inflammatory markers, and a normal set of blood counts.

- The tests of liver functioning are normal—though liver cells are being damaged, there’s enough healthy liver to continue to do its job. The specific antibody tests for the causes of viral hepatitis will take a few days to come back, though that’s where the diagnosis is likely to be revealed.

Moving Forward

- We get in touch with the family, and tell them that the tests confirmed CT has hepatitis; we hope to know the specific cause in a few days. Meanwhile, he ought to stop the Focastapin—we don’t know if that’s causing liver damage, but it could be—and avoid any medications that could potentially contribute to liver damage, especially acetaminophen, the active ingredient in ordinary Tylenol.

- His mom says CT's abdominal pain seems worse now, and you tell her to try a gentle heating pad and ibuprofen, and ask her to bring him back to see you for a recheck tomorrow.

- After you hang up, another thought comes to mind: His mom had become concerned CT had ADHD—that's why he was taking the Focastapin. The core symptoms of ADHD include hyperactivity, inattention, and impulsivity. If CT were a very impulsive boy, perhaps it's possible he did help himself to some acetaminophen, or some other drug you don't know about. We'd better ask him directly about that when we see him again.

- Which we do, the next day. CT returns with his mom, and he's sicker. His mom says the abdominal pain has gotten worse, and there have been several more episodes of vomiting. He can't hold even fluids down.

- CT doesn't look good. He's lying down on the table, and looks pale and uncomfortable. His vital signs include a temperature of 99.7 degrees and a pulse of 98, with a normal blood pressure and respiratory rate. His capillary refill, when you press the color out of his skin and watch it return, is fast.

- He says his belly hurts, especially in the right upper quadrant, and he says he feels like he has to throw up again. His exam is otherwise unchanged from yesterday, with some right upper quadrant tenderness. There is also possibly some liver enlargement.

- CT needs some fluids—he hasn't been drinking well, and he's been vomiting. In the office, we try giving CT a safe medication for nausea, called ondansetron. Then we start giving little sips of an electrolyte solution every 10 minutes. CT doesn't feel like talking much, but when you ask him about taking other pills or medicines he denies that.

- Rehydrating a child orally can be a lot of work, and it takes patience. The trick is to use only small volumes, perhaps 5 or 10

milliliters at a time, and offer that about every 5 or 10 minutes. The younger the child, the smaller the volumes. Even if there is continued vomiting, these small frequent sips can effectively treat or prevent dehydration.

- However, that's not the way it works out. CT continues to throw up, and becomes more and more uncomfortable over the next hour in your office. He is transferred to the hospital for IV fluids and more effective pain control medication.

- Later that day, the test results come back—CT has elevated antibodies to hepatitis A virus, confirming that diagnosis. His tests for other viruses are negative.

After the Diagnosis

- CT stayed in the hospital for four days, requiring pain medication and IV fluids. There is no specific therapy for hepatitis A—just supportive care while the liver gets better. He had some nausea and belly pain for about six weeks, but eventually recovered fully.

- Most people with hepatitis A have symptoms for up to two months, though some don't recover fully for six months or more. Hepatitis A does not cause chronic or recurrent disease.

- Though CT's symptoms were mainly pain and vomiting, many people with hepatitis A also experience fever, fatigue, and sometimes jaundice or joint pain. Young children, less than six, usually have no symptoms at all—though during the infection, they can and do spread the virus to their household and school contacts.

- That is why vaccination is so important. In this case, and unfortunately in many others, significant illness in one patient and its potential spread to hundreds of others could have been prevented with a simple, safe vaccine, if it had been given on schedule and on time.

If a child has anxiety about a vaccination, jokes and distraction can be a way to relieve their worries.

- Though there is a tiny risk associated with vaccinations, that's a much smaller risk than the risk of not vaccinating. And the best way to minimize the risk of vaccines is to give them on time, and on schedule, the way they're best studied and best understood.

- Another factor: As CT and his sister got older, their mom, in a way, became even more reluctant to agree to vaccines, because her children were so scared of them. But by delaying vaccines, she made it more difficult, psychologically, for her own children. Babies don't worry about vaccines.

- CT's mom chose to put her child at risk by not vaccinating. At the same time, she gave her child a daily herbal supplement for which there's no safety or effectiveness data at all. She chose the unknown risk for unknown benefit over the known, tiny risk for a very significant benefit.

Suggested Reading

Centers for Disease Control and Prevention, www.cdc.gov.

Plotkin, et al, eds., *Vaccines*.

Questions to Consider

1. Why is a travel history important?

2. How can you tell if a person is dehydrated?

Lecture 24

Pediatrics of the Future

In the last hundred years, we've made incredible progress in human health, and in many parts of the world, children are healthier and stronger than ever. Improved nutrition, sanitation, access to clean water, and vaccinations have had a huge impact. New frontiers involving advanced screening, surgery techniques, and even work with human genes also show promise. This final lecture presents several cases to illustrate just how far we've come, and how far we might be able to go next.

Frank's Nephew

- Frank was born in 1950. Shortly after birth he started having problems with chronic diarrhea and poor feeding. He developed sores on his skin and in his mouth, and then fevers and coughing. Though antibiotics had just become widely available, they were ineffective at treating his infections, which included pneumonias and infected skin lesions. He died, in 1950, at five months of age.

- Though of course Frank never had children, his sister did. Her first child was a girl, Katherine, who was healthy and strong. But her second child was very sickly. Not only did this child get a lot of infections, he was unable to get over these infections, with or without antibiotics.

- There was another clue, too: Some of these infections were being caused by organisms that ordinarily don't cause disease in a normal host—that is, in a person with an intact immune system. The hallmarks of an immune disorder aren't just frequent infections, but infections that never seem to clear, and infections with unusual organisms that don't typically make people sick.

- Frank's nephew, despite aggressive care, died at age five. He was diagnosed with an inherited form of immune deficiency called *severe combined immunodeficiency*, or SCID.

- When Frank's sister became pregnant a third time, with another boy, her doctors warned her that this son had a 50% chance of having SCID as well. The best treatment available at that time, in 1971, was to create, essentially, a sterile environment for her baby to live in.

- This child's story was made into a movie, *The Boy in the Plastic Bubble*, starring John Travolta, which aired in 1976. Right after the child was born, he was placed into a sterilized cocoon, and he stayed in a plastic, germ-free environment for his entire life.

- The first successful bone marrow transplant to treat severe immunodeficiency was performed in 1968—but these early transplants could only be between identical twins, who had identical DNA.

- By 1983, new medications and procedures had developed to allow a transplant between less perfectly matched siblings. His older sister, Katherine, agreed to be a donor, and the boy in the bubble received a bone marrow transplant on October 21, 1983.

- By the following February, he became very ill, and he could no longer receive adequate care in his isolated environment. He and his family agreed to let him out of isolation. A few weeks later, he died from what turned out to be lymphoma, a cancer of the immune cells, which had spread throughout his body.

- The lymphoma had been triggered by a simple infection with Epstein-Barr virus that had been dormant in his sister's marrow, and had spread unchecked in a body that had never developed an intact immune system. He died at age 12, and 10 years afterwards, his family released his full real name: David Vetter.

Progress on SCID

- By the mid-1990s, many successful bone marrow transplants had been done, but the treatment was still risky. The transplant could be rejected, or the transplanted cells themselves could start mistakenly attacking the new host. But when the transplant worked, it worked very well. Many children from the 1990s and onwards have led healthy lives after bone marrow transplants for immune deficiency syndromes.

- In David's family, doctors know to beware of the chance of SCID in male children, and to isolate and test children at risk. But historically, that strategy missed a lot of children in the general population, who got sick with intractable infections prior to diagnosis—and this made bone marrow transplant more difficult. A new strategy is now in place in many states to screen all newborns for SCID at birth.

- For some families with SCID, it's now possible to give what's called *enzyme replacement therapy*. Some forms of SCID are caused by a mutation in the gene that encodes an enzyme called adenosine deaminase, or ADA. Lacking this enzyme, immune cells don't function, and SCID is the result.

- A potential therapy, then, is to give injections of this enzyme directly to the patient. Studies of this approach are very promising, though there are still limitations to what can be done, and it's not yet clear that this will provide a long-term solution to all patients with ADA-deficient SCID.

- The next horizon for children with SCID is gene therapy—literally replacing the broken or mutant gene in immune cells with a functional gene.

Spina Bifida

- *Spina bifida* is an umbrella term encompassing a wide spectrum of problems with the development of the spine and spinal cord, caused by an incomplete closure of the spine before birth. This can

leave the delicate spinal cord protected only by a thin membrane that can fill with fluid.

- Historically, more severe forms of spina bifida had a terrible prognosis. The opening in the back prevented the spinal cord from developing normally, leading to paralysis and an inability to control bowel and bladder. There was also a risk of meningitis, and of pressure building up in the brain from impaired circulation of cerebrospinal fluid. Before 1960, the overall survival rate for spina bifida was 10–12%, and most of those children had severe limitations—they were bedridden and incontinent, with severe brain damage.

- Improvements in the lives of these children took place over many years, and depended on advancements from many disciplines. Antibiotics in the 1940s allowed a chance of survival for children with meningitis, and in the 1950s shunts were developed to treat *hydrocephalus*, the build-up of pressure in the brain caused by spina bifida and other disorders.

- As children with spina bifida lived longer, more attention could be paid to longer-term problems. Most children with spina bifida, because of spinal cord damage, never developed the ability to relax their urinary muscles, causing chronic urinary retention and pressure in the bladder that caused irreversible kidney damage.

- In the 1960s, surgeries were developed to divert the urine outside of the body, preserving the kidneys and even, sometimes, allowing urinary continence. Meanwhile, improved orthopedic and neurosurgical techniques were being offered at an earlier age, to close the opening in the back and allow greater freedom and less disability.

- But higher survival rates came at a price. Those shunts that treated hydrocephalus required frequent surgical revisions, and multiple other surgeries were needed to preserve the ability to move joints

and help make walking possible. Such measures were a time sink and could severely impact a child's education.

- Another change started in the 1970s—a growing disability rights movement, including the passage of the Education for All Handicapped Children Act in 1975. By the 1980s, most children with even severe spina bifida could achieve independent mobility and continence, and early and aggressive therapy prevented intellectual disabilities.

- In the 1990s, the new focus on spina bifida concerned prevention. It was shown that folic acid, taken by women during pregnancy could reduce the risk of spina bifida by up to 70%. But this has to be taken starting very early in pregnancy—even before many women know they were pregnant. That's why food fortification is important to make sure that women of child-bearing years are consuming adequate folic acid.

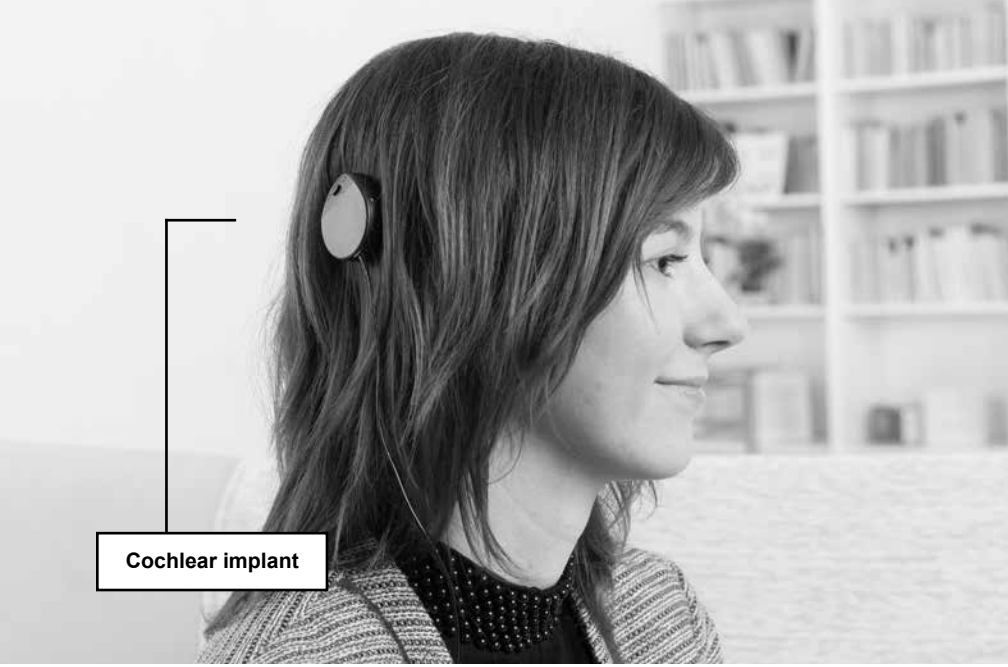
- The newest horizon is fetal surgery—operating on babies to repair the spine defect before they're born. However, fetal surgery itself has risks for both baby and mother, and should only be done at a facility with special expertise.

Eliza

- Another patient can illustrate how much our knowledge has increased, and our approaches have changed. Eliza is a two-year-old child with a chief complaint of: "She's not talking yet." She doesn't imitate speech or babble, and our first impression is that she seems to be living in her own little world.

- The first diagnostic impression many people might have is autism, a developmental disorder that mainly presents with problems with communication, behavior, and social interactions.

- But a hearing test reveals that Eliza is, essentially, deaf—with bilateral, severe hearing loss. Autism and deafness can look very similar, though of course the treatment is different.



- Further testing shows that Eliza has a genetic cause of her hearing problem. With speech therapy, learning to sign, and additional educational supports, Eliza does pretty well—though she never does quite learn to talk quite as clearly as her peers.

- Eliza's case isn't what would typically happen now, though. Our approach has changed with the ability to easily screen newborn babies for hearing loss. Now, Eliza's deafness would be picked up by newborn screening and confirmed within a few weeks. Definitive surgery would provide Eliza with cochlear implants to replace her hearing.

- Eliza, with her cochlear implants, did wonderfully—she was in speech therapy for a bit, and needed regular follow-up with her hearing specialists, but within a year she was speaking entirely normally.

Looking Ahead

- As we wrap up our last lecture of this series, we can look ahead to see what sorts of changes and new developments we might expect to see in the next 20 or so years of pediatrics. One is improved and expanded vaccines. Work is now underway to create and test a vaccine against the resistant staph MRSA. Early vaccines against malaria and HIV also show promise. And soon, hopefully, there will be a universal influenza vaccine.

- The techniques used to develop vaccines to prime a patient's own immune system to fight disease are now being expanded to look for ways to fight non-infectious diseases too, including some cancers and even Alzheimer disease.

- There's also better technology emerging to make screening tests more reliable. For instance, screening pregnant women for fetal anomalies like Down syndrome relies on ultrasounds and indirect measures of metabolites in mom's blood. But newer methods start by collecting the mom's blood, and then isolating the small amount of fetal DNA that has made its way into the maternal circulation. Clinical studies have shown that these tests can be far more accurate than traditional screening methods.

- Many hospitals are starting to offer ever-expanding viral panels that can make a very fast diagnosis, using only a nasal swab, to identify whether an infection is viral or antibacterial. Knowing if a child has a viral infection can help us avoid the overuse of antibiotics, and keep families and children safer.

- We're also going to see an expanded use of what's called pharmacogenomics, which looks at an individual's genetic makeup to determine how medications will be metabolized, and even how well they're likely to work.

- One more trend: Our technology and knowledge are allowing us to help more and more children survive, children that in the past could not have made it. These include children with spina bifida,

cancer, extreme prematurity, and genetic disorders which perhaps require intensive medical or surgical therapy.

- These are our so-called special-needs kids, and they're a rapidly expanding part of pediatric practice. We're seeing more and more children now who have a long list of medicines and health problems, some of which are a direct consequence of our own therapies. As care gets more complex, we're going to need to keep up to protect these children, helping them not only to survive, but to thrive and grow.

Suggested Reading

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Questions to Consider

1. Has advanced imaging with CT and MRI helped make doctors better diagnosticians?

2. What drives changes in the way medicine has been practiced over the years?

Glossary

abscess: A localized pus collection, often forming a pocket or collection.

acetaminophen: A common over-the-counter pain reliever and fever reducer; often goes by the brand name Tylenol.

adenopathy: Swollen or enlarged lymph node(s).

allergen: A protein or other chemical that triggers an allergy.

allergic rhinitis: Allergic inflammation inside the nose.

allergy: An adverse immunologic reaction to an environmental trigger.

anemia: Low red blood cell count.

antibiotic: A medication that kills or slows the growth of bacteria.

antibodies: Serum immunoglobulins that are part of the immune system.

anticipatory guidance: Advice given before a problem arises.

antifungal: A medication that kills or suppresses the growth of fungal organisms.

antihistamine: A medication that counteracts the effects of histamine, typically used to combat an allergic reaction.

Apgars: A scoring system to judge the health of a newborn baby.

aphthous stomatitis: Commonly known as canker sores, small ulcers inside the mouth.

apnea: Cessation of breathing.

arrhythmia: An irregularity in the heart rhythm. Though this term is used commonly, a more exact term that is preferred is dysrhythmia.

arthralgia: Joint pain without evidence of inflammation.

arthritis: Joint inflammation, typically manifested by stiffness and pain accompanied by swelling.

atopy: Predisposed to allergic responses.

bacteria: A unicellular microorganism lacking a nucleus.

bariatric surgery: Surgery intended to assist weight loss.

bilious vomiting: Vomiting stained by bile, typically green or yellow; often an indication of abdominal obstruction.

blanching: Become white or colorless when squeezed or pressed.

board certified: Maintaining requirements by a medical specialty board, typically including passing examinations and fulfilling educational and practice requirements.

candida: A common species of yeast.

capillary refill: The return of color to a blanched extremity.

cardiorespiratory monitor: Electronic device that measures and displays vital signs and often heart and breathing rhythms in real time.

CBC: Abbreviation for complete blood count, a common laboratory test that quantifies the different types of cells in the blood.

celiac disease: An autoimmune condition of the gut and other tissues triggered by the ingestion of gluten.

cerebrovascular accident: Stroke, or brain damage caused by insufficient blood flow.

chief complaint (also **chief concern**): A traditional part of a medical encounter, the chief complaint is typically recorded in the patient's own words, expressing the main reason that the patient sought care.

clinical trial: A scientific investigation that typically compares a new treatment to a previous standard.

coarctation: A stricture, typically of the aorta.

cochlea: The organ of hearing in the inner ear.

concussion: Brain trauma leading to symptoms of brain dysfunction.

confluent: Running together or atop one another, often referring to a rash characterized by individual spots that coalesce and touch each other, appearing as one larger area.

congestion: An excessive or abnormal accumulation of blood, mucus, or other fluids in body tissues.

continence: Ability to voluntarily withhold the passing of (typically) urine.

crackles: A physical exam finding of the lungs, crackles sound very much like the snapping, crackling, and popping sound of milk poured over breakfast cereal. Also called rales.

cranium: The skull, or more specifically the part of the skull that encloses the brain.

CRP: Abbreviation for C-reactive protein, a blood protein that can be measured in the laboratory. An elevated CRP is an indication of inflammation.

CT scan: Short for computed tomography scan, a study that uses a series of X-rays to construct three-dimensional images of internal structures.

dehydration: An abnormal loss of body water.

deny: In medical lingo, “deny” means that the patient says the symptom in question did not occur. It does not imply that the patient is being untruthful.

desensitization: The process of reducing or eliminating the response to stimuli, i.e. allergies or noise.

developmental delay: Attaining developmental milestones later than expected.

developmental deviance: Attaining developmental skills in an unusual order.

developmental regression: A loss of previously acquired developmental skills.

Diagnostic and Statistical Manual: Abbreviated *DSM*, a publication of the American Psychiatric Association that codifies the definitions of mental illnesses.

differential diagnosis: A list of candidate diagnoses to explain a medical problem.

diphenhydramine: A common over-the-counter antihistamine, often sold under brand name Benadryl.

diplopia: Double vision.

ductus arteriosus: An opening from the aorta to the pulmonary artery that closes shortly after birth.

dysuria: Painful urination.

ear canal: The canal from the outside to the eardrum.

echo: Informal shorthand for an ultrasound study, typically of the heart (typically short for echocardiogram, though occasionally used for ultrasounds of other body parts).

edema: Swelling, typically of an extremity.

EKG: Electrocardiogram, sometimes abbreviated ECG.

EMR: Electronic medical record, sometimes abbreviated EHR for electronic health record.

encephalitis: Inflammation of the brain, most typically caused by infection.

encephalopathy: Dysfunction of the brain from any cause.

endocrine: Relating to glands that secrete hormones into the blood.

endoscopy: Using a slender tube to look into the body.

ENT: A surgical specialty, standing for ear nose throat; sometimes referred to as otorhinolaryngology.

enzyme: A protein that facilitates a chemical reaction in the body.

epigastrum: The area of the abdomen over the stomach—in the middle, above the umbilicus.

epilepsy: A neurologic disorder characterized by recurrent seizures.

epiphysis: The end part of a long bone, past the growth plate (the physis).

extrapyramidal: Nerve tracts outside of the pyramidal tracts, involved in involuntary movement control.

family practice: A board-certified medical specialty that provides primary care to patients of all ages, often including obstetric care and minor surgery.

fever: An elevated body temperature.

frequency: Typically short for urinary frequency.

functional illness: Symptoms that cannot be ascribed to any abnormality on an objective test, such as an X-ray or blood test.

general practitioner: Physicians who treat general conditions; this title does not require a residency or board certification.

generic: Referring to medications, generic means manufactured by a company that does not own the patent.

genetic: Relating to the genes, or the sequences of DNA encoded in cells that directs their functioning.

giardia: A protozoan intestinal parasite.

glomerulonephritis: Inflammation of the kidney, often causing bloody urine and high blood pressure.

glucosuria: Glucose in the urine.

gluten: A protein found mainly in wheat.

grand rounds: Medical education sessions typically presented to physicians and students, usually surrounding a single case presentation.

hay fever: Informal for allergic rhinitis.

HEENT: Head, ears, eyes, nose, and throat, referring to these areas of the physical examination.

hematocrit: A measure of the volume of blood that is taken up by red blood cells, expressed as a percentage.

hematuria: Blood in the urine.

hemoglobin: The molecule in red blood cells that binds oxygen. Hemoglobin often refers to a quantitative lab measurement of the concentration of this molecule in a blood sample.

history of present illness: Abbreviated HPI, a chronologic account of a patient's symptoms.

hormone: A substance secreted into the blood that controls functions at a distant site, for example insulin.

hyaline membrane disease: Also known as respiratory distress syndrome, caused in newborns from a lack of surfactant, typically seen in premature babies.

hydration: Fluid status, especially regarding water.

hyperdynamic: Moving a lot.

hyperthyroidism: Overactive thyroid functioning.

hypoglycemia: Low blood sugar concentration. Contrast with hyperglycemia (high blood sugar) or euglycemia (normal blood sugar).

hypothyroidism: Underactive thyroid functioning.

hypoventilation: Insufficient breathing, resulting specifically in increased carbon dioxide in the blood.

ibuprofen: A common over-the-counter pain and fever reliever, commonly sold as brand names Advil and Motrin.

idiopathic: Of unknown cause.

IgE: Immunoglobulin E, a specific subtype of antibody that's often associated with allergic disease.

IgG: Immunoglobulin G, the most common subtype of antibody circulating in blood.

immune globulin: Proteins that assist immunity; often called antibodies.

immunization: A vaccination that confers immunity, or the process of receiving the vaccine.

incidentaloma: An informal word referring to something found on a test or radiology study that is unrelated to the problem being investigated.

inflammation: A physiologic reaction to infection or stress that can include redness, swelling, pain, and warmth.

inoculation: Though sometimes used interchangeably with immunization, this more specifically means the introduction of a microorganism into a host or growth medium.

insulin: Hormone secreted by the pancreas that regulates glucose homeostasis.

intellectual disability: Impaired cognitive or intellectual functioning. Often used synonymously with or as a preferred term for mental retardation.

intern: A graduate of medical school training in the first year after graduation.

internal medicine: A medical specialty that concentrates on the diagnosis and management of non-surgical problems in adults.

internist: A physician practicing internal medicine.

intracranial pressure: The pressure inside of the skull.

intractable: Never ending, or difficult to treat.

intravenous (**IV**): Within a vein.

intubation: Placing a tube within a hollow organ, most commonly referring to an endotracheal (breathing) tube placed in the trachea (airway).

irritable bowel syndrome: A condition of chronic abdominal complaints without objective pathology.

jaundice: A yellow color to the eyes and skin caused by excessive bilirubin in the blood.

lactose intolerance: An inability to digest the mild sugar lactose.

laparoscopy: A surgical procedure using optical instruments inserted through the abdominal wall to view the inside.

laparotomy: A surgical procedure including an incision into the abdominal cavity.

laryngomalacia: A floppy upper airway, or larynx.

lesion: A region of an organ or tissue that has been damaged.

leukemia: Cancer of the blood-forming elements in the bone marrow.

LFTs: liver function tests; more properly, transaminases, a collection of blood tests that indirectly measures the health of liver cells.

lordotic: The normal forward curve of the lower back.

lumbar puncture: Sometimes called a spinal tap, inserting a needle between the vertebrae to collect cerebrospinal fluid or instill medication.

lymph node: A collection of lymph or immune fighting cells.

lymphoblasts: Very immature cells in the lineage of lymphocytes, not seen in the peripheral circulation.

meningitis: Inflammation of the lining of the brain.

metabolic: Related to chemical processes that sustain life.

middle ear: The space between the eardrum and the round window.

milestones: Developmental markers, such as specific skills expected at specific ages.

MRI: Magnetic resonance imaging, using a strong magnetic field and radio waves to get detailed images of internal organs.

murmur: A noise heard over the chest with a stethoscope caused by turbulent blood flow through the heart.

narcotic: A class of pain relievers derived from opium or morphine.

natural consequence: What happens naturally that follows an antecedent.

natural history: What happens when a disease or process is allowed to run its course without therapy or intervention.

nausea: A feeling of queasiness, or that one is about to vomit.

negative: In medical use, negative means that the inquired symptom or finding is absent. It does not imply that this is good or bad.

negative reinforcement: Reinforcing a response by giving an unpleasant stimulus when the response is not made.

obesity: A BMI over the 95th percentile.

off-label: Using a medication contrary to the FDA labeling.

opioid: An opium-like compound, informally synonymous with a narcotic.

organic illness: An illness that includes objective abnormalities on a blood test or radiologic study that correlates with symptoms.

ossicles: The three bones in the middle ear that transmit sound waves.

palpate: To feel, as in part of the physical exam.

pathology: Diseased tissue, or the collective features of a disease, or the branch of medicine that studies diseased tissues.

percentile: A value that divides the distribution into 100 groups of equal frequency.

peritonitis: Inflammation in the lining of the abdomen.

petechiae: A physical finding of the skin, appearing as small broken blood vessels or red-purple, non-blanching spots.

plagiocephaly: A misshapen head.

plasmapheresis: A medical procedure that separates out the plasma from the whole blood and then filters out certain elements, typically proteins, before returning the blood to the body.

platelets: A kind of blood cell involved in clotting.

positive: In medical lingo, used to denote a finding that is present. It does not imply whether this finding is good or bad.

positive reinforcement: Giving a positive, pleasant reward after a behavior in order to increase its frequency.

primary: A problem or finding that isn't caused by something else. For example, a primary headache isn't caused by some other medical condition.

problem list: A mental or physical list of a patients problems, including symptoms and signs and abnormal findings.

prodrome: Mild symptoms that occur at the start of a (typically) viral illness.

pulse oximeter: A device that measures the pulse and oxygen saturation in blood, often abbreviated pulse ox or POX.

pulse rate: A count of heartbeats per unit time, such as beats per minute.

quadrant: One of four areas of the abdomen, as divided by a Swiss cross.

rales: Synonymous with crackles, a physical exam finding of the lungs.

red blood cells: The cells in the blood that carry oxygen.

referred pain: Pain that is perceived in a different location than where the tissue damage is occurring.

respiratory distress syndrome: See hyaline membrane disease.

review of systems: Part of the medical interview, with a series of questions organized by organ system to see if specific symptoms have been present.

secondary: A symptom or problem caused by some other medical problem. For example, a secondary headache may be caused by a sinus infection, concussion, or brain tumor.

sedimentation rate: A blood test of inflammation, often abbreviated sed rate or ESR.

seizure: A sudden disruption in the normal electrical activity of the brain, accompanied by altered consciousness, movements, or other neurologic manifestations.

sensitization: Becoming more responsive to a stimuli, such as an allergen or loud noise.

sensorium: The brain function that responds to stimuli.

sepsis: A whole-body inflammatory condition, triggered by serious infection.

seroconversion: When blood tests show that a person has been exposed to an infectious agent by demonstrating the presence of specific antibodies against that infection.

shock: A life-threatening state of insufficient blood flow to multiple organs.

sign: A physical finding that can indicate the presence of disease.

sleep associations: The environmental cues that occur with sleep.

spidey sense: A vague sense that something is wrong or that there is imminent danger.

spirometry: Tests of lung functioning.

stenting: Using a hollow tube to hold open a hollow organ, typically a blood vessel.

stricture: A narrowing of a hollow organ, such as the esophagus or a blood vessel.

stridor: A high-pitched, inspiratory noise from the upper airway.

superinfection: An infection that occurs on top of a first infection.

symptom: A patient's complaint.

syncope: A brief loss of consciousness caused by insufficient cerebral blood flow, synonymous with fainting.

syndrome: A group of symptoms that occur together with a specific condition.

tachycardia: Fast heart rate.

tenderness: Pain that is increased with palpation.

tympanic membrane: Eardrum.

ultrasound: An imaging modality that uses high frequency sound waves to capture images.

urinary frequency: Urinating more often than expected.

vaccine: Typically synonymous with immunization. A product administered to encourage the development of an immune response and resulting immunity.

vertigo: A spinning sensation, or feeling that one's environment is spinning around.

vestibular: Related to the sense of balance and position-sense.

virus: A small infectious agent that does not contain its own cells or organelles.

vital signs: Collectively, clinical measurements of pulse rate, blood pressure, respiratory rate, and temperature.

vitamin: One of a group of compounds that are essential to be ingested in small quantities to maintain health and life.

wheeze: A physical exam finding of the lungs, heard best with a stethoscope. Wheezing sounds like air rushing through small tubes, and is most typically heard in expiration.

white blood cells: Cells in the blood that are part of the immune system.

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Internet Resources

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