The Girl Inside You

Sara was waiting for her amniocentesis results. An obstetrician herself, she knew how long the test took to perform, so she was expecting a call from the genetics clinic any day. At thirty-five, she was considered an "elderly primigravida," a phrase she used wryly as she described older first-time moms like herself.

Because of her age, she knew she had a higher risk of having a child with a genetic problem, and so she had chosen to have an amniocentesis. This involved taking a small amount of fluid from around her baby and checking to see that everything was OK.

Finally, the call came.

"We've got your results back," Ginger, the counselor at the genetics clinic told Sara. "The chromosomes are normal. Everything looks fine."

But there was something Ginger had left out.

"What is it?" Sara asked, her stomach doing silly flip-flops. She couldn't explain it, but she wanted a girl, and Ginger, her close friend, knew it.

"Why, it's a girl of course!"

Perhaps, like Sara, you have the results of your amniocentesis, or the ultrasonographer saw the two swellings that identified your daughter's labia at a routine ultrasound. Perhaps this is your first baby and you weren't worried about what sex your baby was. When curious friends asked, "Do you want a boy or a girl?" you replied, "Either, as long as it's healthy," and now you are holding her in your arms. She has just drifted off to sleep so you're trying to read a few pages.

Then again, maybe like Sara, you were hoping for a girl.

Some couples might wonder if it's possible to choose the sex of their baby. Perhaps you have two boys and wanted the experience of having a daughter. You might have asked if there was any way to increase your chances of having a girl. Science comes back with a resounding "NO!"

● BABY GIRL BRAIN FACT ●

Why Does a Doctor Suggest an Amniocentesis?

- You're thirty-five or older and the risk of Down syndrome and other, rarer, chromosomal abnormalities, increases with age. Down syndrome is the result of a baby having an extra chromosome.
- You had a blood test called a triple or quadruple screen at week sixteen of your pregnancy and the results were abnormal. With an abnormal result you are at increased risk for delivering a child with Down syndrome, a spinal defect (spina bifida), or a severe brain abnormality. REMEMBER! It is quite common to have a false positive result. Usually it comes from you or your doctor miscalculating your due date. An amniocentesis and an ultrasound will give you a more accurate result.
- You had an ultrasound, and something abnormal was detected.
- You have a history of a chromosomal abnormality in your family.
- You have already delivered a child with a chromosomal abnormality.

• BABY GIRL BRAIN FACT •

Guaranteeing a Girl, or "Wear the Jockeys, Not the Boxers, Honey!"

Depending on the myth, you should

- Eat lots of vegetables and fish; have chocolate for dessert
- Make love in the afternoon
- Make love on even numbered days
- Make love during the full moon
- Have the female partner initiate sex
- Be sure the male partner has an orgasm first
- Make sure your husband keeps his genitals warm by wearing close-fitting underwear and tight trousers
- Put a pink ribbon under your pillow and a wooden spoon under your bed

Remember:

- All of these suggestions are myths.
- None has held up to scientific scrutiny.
- But the odds are pretty good no matter what you do—you have about a fifty-fifty chance of conceiving a girl!

However you made your girl, you're about to find out how genes, DNA, and chromosomes worked together to create your baby girl and what scientists are learning about why your daughter is so different from your best friend's son, starting from the moment of conception.

If you're curious to know why your friends and family are telling you that girls are unique, read on!

Gene Talk

1. What is DNA? The body is made up of different kinds of cells: liver cells, skin cells, and blood cells, to name a few. DNA is every cell's set of instructions or blueprint. It tells the cell whether it's going to help your little girl taste chocolate or help her do push-ups.

2. What are genes, anyway? Genes are made up of the DNA. They are the instruction manual for your girl's body. They tell her body how to develop and function. Genes determine whether your daughter will grow tall and slender like Uncle Fred or short and squat like Aunt Pearl. Your daughter's genes determine whether she'll have high blood pressure or a tendency toward diabetes. Your daughter has an estimated twenty-five thousand genes.

3. What's a chromosome and where can you find one? In the center of most of your body's cells, you'll find the nucleus, or the cell's command center. Within that nucleus are the chromosomes, the gene holders of your body. Chromosomes come in pairs, like shoes. We each have twenty-three pairs. When you and your partner created your daughter, you each gave her half of the set of twenty-three chromosomes.

4. What makes my girl a girl? Blame it on the sex chromosomes, specifically two X chromosomes. Because all of Mom's cells have two X chromosomes, her eggs will always pass on an X chromosome to her child, male or female. But Dad has two different sex chromosomes, the long and lean X chromosome and the rather puny Y chromosome. Half his sperm will carry an X chromosome, the other half a Y. Your daughter was created when an X-carrying sperm met up with Mom's egg (always carrying an X chromosome). Human girls are XX.

Although your daughter's X chromosomes are long and lean, containing up to fourteen hundred genes, she missed out on one important gene (important to guys, that is) that appears only on that stubby boy-making Y chromosome. It's called SRY and it directs other genes on other chromosomes to get involved in making boy parts, starting off with the all-important testosterone-producing testicles.

• BABY GIRL BRAIN FACT •

A Lot of Neural Mileage

Your daughter's forty-six chromosomes contain so much information that if you wrote it all down, the data would fill a stack of books two hundred feet high! If you pulled the entire twisted DNA from a single cell and stretched it out, it would be as long as a car. If you stretched out all the DNA in a human body, it would stretch to the sun and back six hundred times!

Without the SRY gene, the collection of cells that became your daughter had no choice but to go on its default path—that of the female. Or so it's long been thought. As scientists begin to unlock the secrets of the human genetic code, they are beginning to find evidence that there are ovary-determining genes on the X chromosome.

Without the influence of testosterone coming from a pair of testicles, your daughter's early collection of cells is propelled down a path that is uniquely female.

From Embryo to Baby Girl

Your baby's journey to becoming a girl child started when your husband's X sperm fertilized your X-bearing egg. Initially, the embryo had a "unisex" look about it. If you were able to peek in at that moment you wouldn't have been able to tell if you were having a boy or girl.

Toward the end of your first trimester, your daughter began stage one of the three stages of development that made her a girl. First her ovaries formed. Next came her other internal girl parts, her uterus and fallopian tubes. Finally her vagina and external organs made their appearance.

Step 1: Formation of the ovaries. At about week ten of your pregnancy, your daughter's ovaries began to develop per her genetic plan. While your best friend's fetal boy was inundated with hits of testosterone, your daughter's ovaries were not making much of a contribution to the huge amounts of estrogen that pour out of your placenta. At least *in utero,* estrogen does not drive your daughter's female development. That will happen shortly after birth.

Step 2: Formation of her internal female organs. Just like her male counterpart, your daughter started off with two sets of cords in her abdomen. The Mullerian ducts were the female set and were free to grow because there was no SRY gene to stop them. These ducts were destined to become her uterus, fallopian tubes, and the upper part of the vagina. The Wolffian ducts, which would have grown into boy parts, wither away, unused.

Step 3: Her external girl parts. Up until about eleven to twelve weeks of pregnancy, your daughter's genital area was rather nondescript. There was nothing on the outside that could tell you if

this was a boy or a girl. Even though female hormones will be held responsible for much about your daughter's future female development and behavior, it is her female genetic code, not her hormones, driving the growth of her clitoris, labia, and lower vagina.

You Can't Blame It on Her Hormones

Your daughter's ovaries are not doing much in the way of producing estrogen *in utero,* thus her journey to womanhood, at least before birth, is determined by girl-promoting genes, unhindered by a Y chromosome's interference. Without the stormy hits of testosterone your nephew was exposed to, your daughter's reproductive anatomy develops in a leisurely fashion. Your daughter won't experience her "hits" of estrogen until she is out of your body.

The first series comes shortly after birth, and lasts for the first six months of life, continuing the work that began *in utero.* During this time your daughter's ovaries begin producing estrogen at levels not seen again until she is an adult. Her female brain circuitry soaks in this bath of female hormones. At the same time, these estrogen hits take responsibility for getting your daughter's reproductive structures ready for her to make babies of her own. Yes, we know that seems eons away!

The second hit of estrogen comes with puberty. This sets the processes in motion that will change your girl's body into that of a woman. Starting a few years before your daughter actually gets her first period, her stick-straight girl body will gradually develop curves, and grow underarm and pubic hair. Her breasts will emerge, and she'll probably complain that they hurt.

Without testosterone interfering, your daughter developed not only female genitalia but a decidedly female brain. Estrogen will later

be the hormone responsible for the physical changes your daughter will experience, but in the meantime it is your daughter's girl brain that will direct her female approach to the world.

Is Your Girl's Brain Different from Her Brother's?

Yes. Absolutely.

The latest research shows that testosterone and its buddies have profound effects on the formation of the male fetal brain. Put testosterone in the mix and some cells in some areas are destroyed while other areas of the uniquely male brain, generally less verbally and emotionally oriented, develop. Without testosterone your girl's communication and emotion centers develop unperturbed.

In the early days of your pregnancy we were unable to differentiate between a male and a female embryo's genitalia. We also wouldn't be able to differentiate between a male and female brain. We all start out the same. But even before you missed your period, your daughter's nervous system was beginning on its complicated path.

How Does a Baby Girl's Brain Grow?

By the time you had taken an early pregnancy test and gotten the news, your daughter's brain was starting to form. Your baby was little more than a tiny flat disk floating over a ball of cells. The transformation of this fertilized blob of chemically driven cells into a young woman who will solve complex problems, talk on the phone for hours, and read chemistry textbooks is an amazing process.

A microscopic groove developed along the length of the tiny disk. The groove deepened and eventually sealed its edges over to form

a long tube, called the neural tube. By five weeks, the organ that looked like a lumpy inchworm had already embarked on the most spectacular feat of human development: the creation of the deeply creased cerebral cortex, the part of the brain that will eventually allow your daughter to move, think, speak, plan, and create. The brain of your growing girl changes so much over the next thirty-four weeks that researchers are able to tell you how many weeks pregnant you are by looking at your daughter's brain!

• BABY GIRL BRAIN FACT •

Brain Space

At birth, girls' brains on average are smaller than boys' brains. Your daughter will have the same number of neurons as a boy, but she will jam more into less space, the female brain's equivalent of wearing a girdle!

What's Unique About a Baby Girl's Brain?

Your daughter's brain will perform millions of tasks in a uniquely female way.

Without the influence of the Y chromosome, the fetal girl brain takes on the structure and function of a female brain. Some areas of her brain will be larger than in a boy's brain, others smaller. In certain areas of her brain, there will be more connections between brain cells than in a boy's brain.

Her brain will

- Control her body temperature, blood pressure, heart rate, and breathing

- Translate a flood of information about the world around her from her eyes, ears, nose, and taste buds
- Regulate her physical motion when walking, talking, standing, or sitting
- Think, dream, reason, and experience emotions

And this is all done by an organ that is about the size of a small grapefruit!

A Quick Tour of the Baby Girl Brain

The key players in your daughter's brain are

1. The cerebrum. The biggest part of the brain is the cerebrum, also called the cerebral hemispheres. Most of the brain's weight, 85 percent, is devoted to the cerebrum. The cerebrum is the seat of higher brain functions—thinking, reasoning, speaking, and interpreting the environment. Memories are stored here, and emotions processed. When your daughter starts to crawl, her cerebrum will tell her arms and legs what to do.

2. Cerebellum. The cerebellum is at the back of the brain, below the cerebrum. Although a lot smaller than the cerebrum, only one-eighth of its size, the cerebellum is a very important part of the brain. It controls balance, movement, and coordination (how your muscles work together). Because of your daughter's cerebellum, she will be able to stand upright, keep her balance, and spin circles through her world.

3. Brain stem. Another small but mighty brain part is the brain stem, which sits beneath the cerebrum, in front of the cerebellum. The brain stem connects the brain to the spinal cord and is in charge of all the basic functions your girl's body needs to stay alive—breathing air, digesting food, and circulating blood.

4. Pituitary gland. The pea-sized, powerful pituitary gland is in charge of making your girl grow large by producing and releasing growth hormones into her body.

5. Hypothalamus. Last, but certainly not least, is the hypothalamus, the brain's regulator of emotions, body temperature, and food and water intake. At some point your daughter will tell you to stop putting a coat on her because YOU are cold—and you can thank her hypothalamus for that!

How Does a Tube Turn into a Brain?

The neural tube (the sealed-off collection of early cells) starts to imitate a pretzel by swelling, folding, and contorting to form the various parts of the brain. It divides into the forebrain, midbrain, and hindbrain. This tube's divisions turn into the brain parts listed above. Your little girl's eyes and nose will develop from the division of the neural tube that became the forebrain. This area also develops into the cerebrum and the hypothalamus. The midbrain is destined to become the brainstem. The hindbrain will become the cerebellum. Your daughter's brain is growing rapidly at this point. If you were looking in on her now, you would be struck by her odd look. She's almost all head!

Inside the tube, the cells divide rapidly and cause the tube to thicken. Some of these cells become neurons or nerve cells. Neurons are initially produced in the central canal of the neural tube. Although they are born there, they don't stay put and will migrate to their final destination in the brain. These cells collect together to form the different centers of the brain and spinal cord, and they send out axons, long, threadlike extensions that connect with other nerves.

At nine weeks, the embryo's ballooning brain allows your daughter to bend her body, hiccup, and react to loud sounds.

By week ten your girl's brain is producing almost 250,000 new neurons every minute!

By your second trimester the grooves and furrows of your daughter's brain begin developing. Nature takes advantage of these peaks and valleys to cram as many neurons as possible into a relatively small space.

By forty weeks, or term, your daughter's brain is an engineering masterpiece!

Is Your "Girl Pregnancy" Different from a "Boy Pregnancy"?

Yes, but you're not likely to notice. Here's what researchers have found so far:

- Even though a boy fetus may move around more *in utero,* your girl fetus is moving her mouth more than her male counterparts. This early practice prepares your daughter for the future hours on her cell phone!
- Feeling nauseated? Girl pregnancies produce more of the pregnancy hormone hCG. Researchers think high levels of hCG might be related to a severe form of morning sickness called hyperemesis.
- At each week of pregnancy, girls weigh less than boys, so that when they're born, girls weigh on average a half pound less than boys. Their heads are smaller, and they're shorter than the boys. Those little heads are easier to deliver and you are less likely to need a C-section.

• BABY GIRL BRAIN FACT •

The Old Wives Weigh In

Here's some wisdom from a time-honored source—"The Old Wives"—and they say you're carrying a girl if

- Your baby's heart rate is more than 140 beats per minute.
- Your husband gains weight during your pregnancy.
- You're carrying the baby high.
- You're moody.
- Your hands are softer than when you weren't pregnant.
- You crave chocolate.
- You break out with acne.

We're still learning what makes girl pregnancies different from boy pregnancies. It's an active area of research, so stay tuned!

Will My Girl Be Okay? Ten Simple Things to Do

Now that you're pregnant, you're probably paying closer attention to your diet. Getting the right nutrients is not only important for your little one's health—it can affect her intelligence too. Certain foods positively affect your girl's memory and capacity to learn, and others can hinder proper brain development. These smart moves will help you maximize your future Madame Curie's learning.

1. First of all, strive to gain the right amount of weight. Obstetricians recommend that women of normal weight gain between twenty-five and thirty-five pounds during their pregnancy. A study from the National Institutes of Health found that women who

follow that prescription have children with higher IQs than kids born to moms who gained more or less weight during their pregnancy. This is sort of a domino effect, as your prenatal weight gain affects your baby's birth weight, which, in turn, affects his brain size and IQ. Gaining too much or too little weight during pregnancy can lead to birth complications that can affect your baby. Women who are over- or underweight should check with their OB or midwife to find out their recommended weight gain.

2. **Get those vitamins and minerals.**
    - Without enough **iron**, important areas of your baby's brain won't grow as they should, and this could lead to permanent damage. Red meat, beans, fortified cereal, and spinach are wonderful sources of iron.
    - **Folic acid** is critical for the proper development of the neural tube. Eat some leafy green vegetables, such as kale and spinach. Dried beans and orange juice are also good sources. Fortunately, most breads, cereals, and grain products are fortified with extra folic acid.
    - There's new evidence linking adequate **calcium** intake to a decreased risk of severe toxemia—a pregnancy complication that can result in preterm delivery and improper fetal growth.
    - **Take your prenatal vitamins—even when you can't stomach the food!** It's often hard for a pregnant woman to take in all the nutrients she needs, especially during the first trimester of pregnancy, when the smell or taste of any food might send her to the toilet bowl rather than the kitchen table.

      The prenatal vitamins your doctor or midwife recommends are specially formulated for pregnancy. And

before you ditch your vitamins because they make you sick, try taking them with food, or change brands.

Remember, prenatal vitamins are meant to supplement a well-balanced diet. They are not meant to replace the nutrients you need, merely add to them. Prenatal vitamins don't contain all the calcium and iron you need, for example.

3. Make sure you visit your dentist regularly. Women with gum disease are more likely than those with good gum health to deliver their babies prematurely. Some studies suggest that risk may be up to nine times higher! And being premature is not good for your baby girl's brain. Your natural incubator, your uterus, is better for her than any high tech machine in the neonatal intensive care unit.

4. Get your thyroid tested. Many women have an underactive thyroid gland that often goes undetected. A simple blood test can let you know whether you need to take a thyroid supplement, which can easily correct the problem. Children born to mothers with untreated thyroid disease during pregnancy score lower on IQ tests than children born to healthy moms.

5. Bump up your choline. The nutrient you never heard of is critical for your daughter's normal brain development. Studies in animals indicate that choline plays a crucial role in the construction of two major brain centers for learning and memory. A diet low in choline during pregnancy can permanently harm your baby girl's brain chemistry and development. Moms-to-be need 450 milligrams of the nutrient each day. That's easy if your diet includes eggs, beef, and dairy products. Soybeans are also a good source.

6. Eat fish, an excellent food, but certain fish can have high concentrations of mercury and should be avoided. Don't eat shark, swordfish, or king mackerel. Mercury can affect your daughter's brain

development, and not in a good way. But fish, rich in omega-3 fatty acids, may boost your baby's brainpower.

7. Pump up the protein. Proteins are your girl's first set of building blocks. They help her grow from a single fertilized cell to a cuddly bundle. That's an awful lot of work for a little girl, and she needs your help.

• BABY GIRL BRAIN FACT •

You Really Are What You Eat

So is your little girl. In a study from Harvard Medical School, the more fish women ate during the second trimester, the higher their babies scored on a mental development test at six months of age.

8. Stay away from alcohol. Alcohol is not good for developing babies. Alcohol passes directly through the placenta to your baby, and your baby's blood alcohol level will be about the same as yours. So if you're feeling tipsy, so is she. Alcohol can lead to brain damage. The most dangerous time seems to be during the mid second trimester, coinciding with rapid brain development, but no time is completely safe.

9. Give up the cigarettes while you're at it, and avoid illegal drugs. Babies whose mothers smoke are at even greater risk for being born prematurely. A smoking mother's placenta is smaller and doesn't work as well. Cigarette smoking actually raises testosterone levels in girl babies! Even worse, research indicates that girls born to smokers are four times more likely to take up smoking as adolescents, and to continue smoking, than girls whose mothers didn't smoke during pregnancy.

10. Get your body moving. It's good for you and may help boost your daughter's brainpower. There's evidence that at five years of age, children born to mothers who exercised while pregnant performed significantly better on general intelligence and oral language tests. The vibrations or sounds exercise causes *in utero* may have boosted neurological development. Not to mention exercise helps keep your weight gain under control!

• BABY GIRL BRAIN FACT •

Mom's Stress

Maternal stress is passed on to fetuses. These stress chemicals can interfere with the production of brain neurons and synapses. There's some evidence that females exposed to stress *in utero* startle more easily and are more anxious than males. Ideally, a female fetus needs to find herself a happy, contented mom with a supportive spouse. That might not be realistic, however! We all have bad days, but if you are continually feeling overwhelmed by responsibilities, depressed, or angry, we recommend you seek help. It's OK to ask a professional for assistance for problems you can't resolve with the help of family or friends.

What Else Can I Do for My Baby's Brain?

Various authors and "experts" have suggested hyper-stimulating your baby at regular intervals to assist in her brain development. Suggestions include speaking to her through a paper tube, playing Mozart, reading to her in a foreign language, or shooting flashing lights at the mother's abdomen.

• BABY GIRL BRAIN FACT •

The Role of Music

Listening to a soothing sonata is a great way to relax during pregnancy, but it won't make your baby any smarter. There is no evidence that playing classical CDs or foreign language tapes will boost your girl's brainpower, either before birth or after.

Does such stimulation work? There are numerous testimonials in advertisements supporting these methods. Users swear that their children are smarter, more physically coordinated and socially adept than average. Scientists, however, are skeptical. There is no way to really test how a baby would turn out with and without this stimulation.

No one can say for certain when a fetus is awake, so interfering with jabs to the abdomen may be interfering with your girl's natural sleep patterns. It seems counterintuitive to wake a sleeping newborn baby. Why would you do such a thing *in utero*?

Gently talking to your baby, however, seems to pose little risk, and in fact may help you as much as your baby. Thinking about your girl, talking to her, having your spouse talk to her, will all help to prepare you for this new girl who's going to jump into your life and turn it and herself upside down.

By now we hope you have a pretty good idea how genetics and hormones have combined to shape the baby girl in your womb or in your arms. Next, we'll give you a preview of what to expect this coming year and beyond, and what you and your husband can do to nurture the nature of this baby girl.