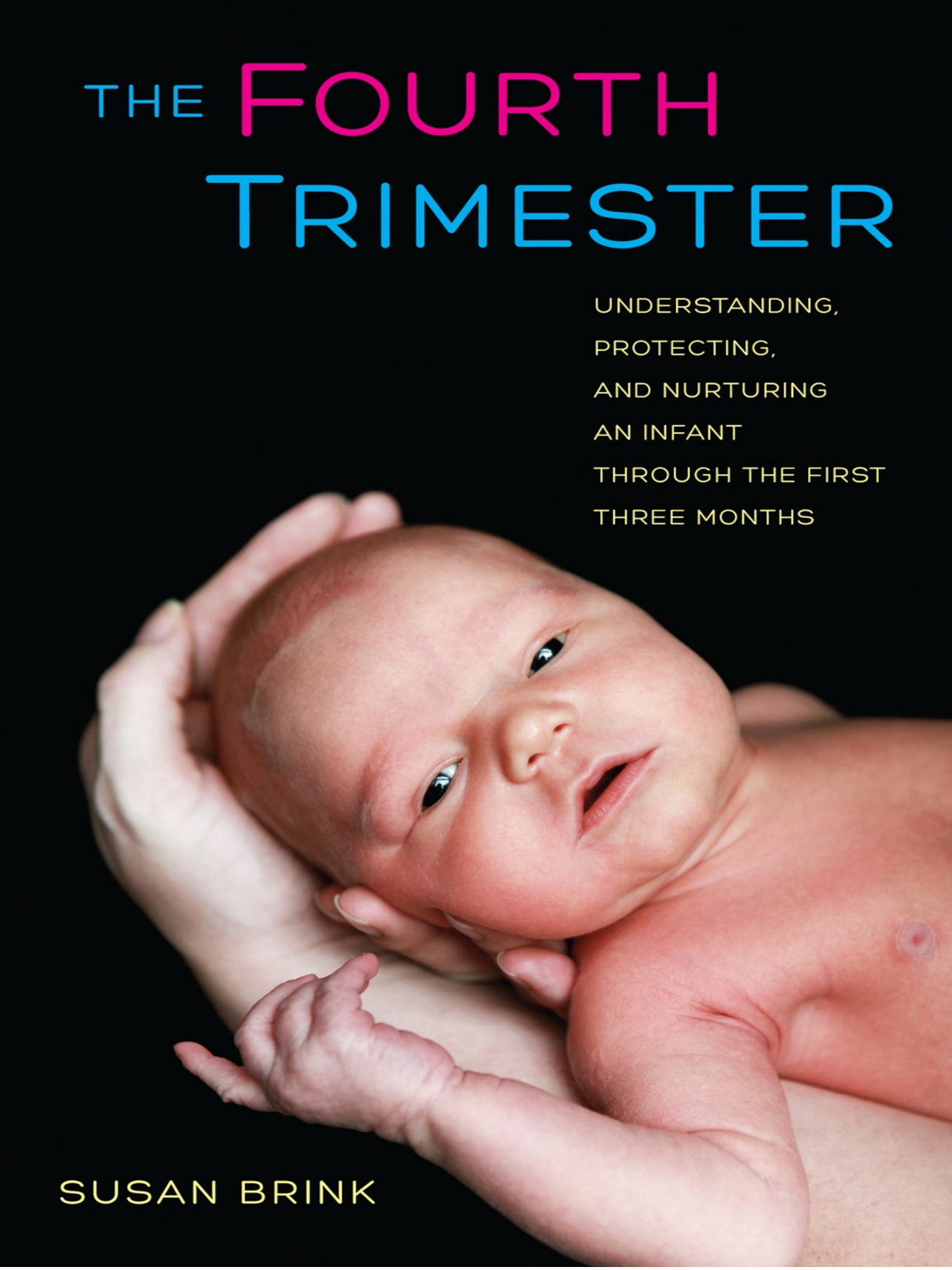
THE FOURTH TRIMESTER

UNDERSTANDING, PROTECTING, AND NURTURING AN INFANT THROUGH THE FIRST THREE MONTHS



SUSAN BRINK

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Susan Brink

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To Max, Makayla, Maggie, Ariana, Carissa, and Molly

And in loving memory of Nancy

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PREFACE

My commitment to write a book about the newborn's first three months come from my own life. I married very young and have two daughters and s grandchildren. Yet nothing from my maternal experience or from my professiona background as a journalist specializing in science and medicine eased me or m grown children through the sudden shock of being completely responsible for th life and development of a brand-new human being.

On my desk I have photographs that tell the story. The snapshots I took a fe days before my daughters became mothers show them proudly posing with the full-term pregnant bodies in profile, their smiles broad and genuine. Then comes shot of my daughter Jenny, triumphant with her newborn Max, but her smile ha become uncertain. The same uncertainty is written on Rachel's face in yet anothe snapshot, her eyes wary and full of doubt, posing with one-day-old Makayla. A brand-new mothers, my daughters had had their confidence seriously shaken.

I look at those photographs and recall my own shock decades ago when nurse handed over my firstborn. How could they be so reckless as to entrust a helples new human being to clueless me?

We all made it through, my daughters and I, as new parents do. Yet I know tha for the first three months we relied on trial and error, intuition, dumb luck—an the passing of time.

Three months, said pediatricians, other mothers, friends, and family. Just han in there for three months, and the mysterious and demanding infant will becom more human, more like the baby you imagined. Since embarking on the researc for this book, I understand in a deeper way why, during the fourth trimester o development, an infant is not like the baby that people imagine. I want others t be able to do more than just hang in there while they anxiously wait for thre months to pass. This book is for parents, grandparents, friends, family member physicians, and students, every single one of them eager to do the right thing b each infant he or she encounters. I want everyone who is in awe of and in lov with a newborn to understand exactly how to protect and nurture an infan during the first three months of life—the critically important fourth trimester.

Susan Brin

Introduction

A Transition from the Comfort of the Womb to the Reality of the World

Like parents everywhere, David and Tammy DiGregorio were under the illusio that they were ready for the arrival of their firstborn child. They knew she was girl and that they would name her Ava. The West Hollywood parents had carefull gathered an extensive array of newborn equipment, read the recommende books, taken Lamaze classes, practiced panting and breathing for her birth, an attended newborn classes offered by their hospital. And sure enough, the birt delivery, and hospital stay went off without a hitch.

Then they brought Ava home, and all anxiety broke loose. “I was terrified,” say Tammy. “I was handed this little baby, and it was a complete shock. I was so tire and so scared; I felt like I was in a whole other world,” she continues. “And I wa terrified of making a mistake.” As for baby Ava, well . . . “She was like a strang little alien.”[1]

Such is the coming-home of many, alas most, newborns who are long awaite and eagerly welcomed. Before women even have time to complete a full sigh relief signaling the end to forty weeks of awkward discomfort, they fin themselves facing even greater challenges. Only now, with actual infants in the arms, they have far less control. Ava, like any newborn, was barely equipped t stay alive. Tammy and David were suddenly face to face with the mos neurologically immature of all the earth's primates, born months before she wa anywhere near ready to function in the world.

Parents around the world who welcome mysterious new life in this wa encounter a significant void in up-to-date scientific information about the firs days and weeks of infancy. With fingers crossed, they confront their uncertaint and fears.

This book presents a new paradigm of a baby's early life that shifts our focu and alters our priorities. It shows that this window of time, specifically the firs three months of life, has more in common with what came before than with wha follows. The fourth trimester is an outside-the-uterus period of intens development that is an extension of the work begun during the first nine month A newborn human is not so much a baby as a final-phase fetus living through time of transition as he gives up the comforts of the uterus and gradually adjus

to the wonders and challenges of the world. Further, during this period infant and mothers need to stay almost as tightly bound together as biology dictate during the first three trimesters. In this book, I use the model of a fourt trimester to show how parents, caregivers, doctors, and students migh understand this period by looking at it through a new lens.

Throughout, I talk about the essential bond between a loving, committed, an attentive adult and a baby. Sometimes that attachment is biologically unique t birth mother and baby. Born recognizing her voice and her smell and, for most o human evolution, dependent on her milk, an infant bonds most quickly with h mother.

But in our complex and ever-changing society, it's important to think broadl and not give short shrift to any woman or man who “mothers” an infant. A adoptive parent—mother, father, married, single, gay, or straight—can reac references to “mother” and “father” in these pages and know it speaks to ther just as it does to biological parents. Be assured, this is not simply lip servic Though biology counts for a lot in favoring birth mothers, the book's importanc to fathers and nonbiological parents represents more than an artifact of the pas few decades of a changing culture. The bond between parents and non-biologica offspring represents an evolutionary moral and medical breakthrough o parenting that no doubt is being, and will increasingly be, studied ove generations.

Within this book, the advice and much of the science can apply to all who giv birth to or adopt babies, as well as to those who watch over, nourish, nurture, an protect an infant in the first hours and days of life. Under that wide umbrella, mean to give respectful due to all kinds of parents—birth mothers and father adoptive parents, same-sex partners, single parents, grandmothers, grandfather and all manner of kith and kin. Any one person or pair or team of peopl responsible for the nurturance, care, and protection of a newborn is fully able t provide, and can be equally expert in providing, the love, diligence, and attentio that every baby needs.

Infants are nothing if not flexible, ready to respond to love. Here's an analogy. had a cat once, a calico, that loved me best. She curled up on my lap. She slept i my bed. She was as cozy with me as a cat can be. But once, she disappeared fro the house for a few days. I put up posters, and soon a man was at my door holdin my Irma. What surprised me was how quickly she had switched allegiance. Sh was curled up in this stranger's arms as though he were the love of her life. almost hated to separate them as he handed her back to me.

This is not just the sentimental musing of a pet lover. Certainly, newborns are lot more complicated, but in some ways they're a bit like my fickle cat. An infan will love the one she's with. And long before she can show love, she will respond t the one she's with. He can be fed with a tender touch, with locked-in eye contac from a birth father or mother. She can have her diaper changed to th accompaniment of chipper conversation by an adoptive parent and, in the blink o an eye, will recognize his voice above all others even though she didn't hear it i

the womb. He can listen as a same-sex couple sings a lullaby duet. The mothe
who supplied the egg responsible for half his genetic makeup—but whose uteru
did not house him—can soothe him. The father who devotes himself to the baby
regardless of whose sperm fertilized the egg all those months ago, can rock her t
sleep. Newborns will thrive even as the definition of *family* changes to incorporat
not only traditional marriages and adoptive parents but also gay marriage
single-parent families, combined families, grandparents raising secon
generations of children, and as many configurations as loving people can come u
with to create the protective, nurturing nest that is a family.

Combining contemporary science with the personal stories of dozens o
parents I interviewed—as well as a few of my own—I've attempted to write to a
who nurture. Science has a lot to say to each and every one of them about th
hows and whys of caring for a newborn. The word *caretaker* or *caregiver* is hardl
sufficient to describe a person who changes diapers, is at the ready at all hour
sings, soothes, tries to project a calm front despite his own worry, plays, feeds
rocks, cradles, and would throw himself under a bus to protect a newborn. Bu
loving caretaker and *caregiver* are convenient shorthand terms I sometimes use
Know that these are written with profound respect for all the people who love an
tend to every need of a newborn throughout the fourth trimester.

The infant, amazingly competent yet totally dependent, needs all of them. Th
nine-month gestation prepared the fetus well, but incompletely. A newborn ca
hear, but cannot sort through the din. He can discern light, shadow, and contrast
but cannot “see” as we understand vision. She can feel, but the womb provide
protection and warmth that she continues to need postpartum. In the uteru
taste and smell filtered through amniotic fluid, making him recognize the odor o
colostrum and the taste of mother's milk. The newborn is prepared to begi
learning the new world she's entered, but this period, which is closely linked t
fetal life and is beginning to prepare her for real life, is one of transition durin
which she needs close, constant, and loving attention.

This book is primarily intended for new parents and caregivers who want mor
than to be told how to care for a newborn. They want to understand the reason
behind the advice. It will also be useful to anyone called upon to give guidanc
(doctors, nurses, teachers) and to those with a personal interest in understandin
the well-being of a newborn (friends, relatives, grandparents). Each chapter o
this book translates the most current science in a specific area of early infan
development into a rationale for appropriate care. In a field where opinion an
trendy advice are seldom connected to evidence, this book presents a clear an
much-needed alternative.

Journalism skills, honed over a thirty-year career in medical reporting, helpe
me to arrive at this reasoned and evidence-based alternative. Journalists ar
adept at following all leads while pursuing a range of sources. They get a
overview of an issue—not merely the pediatrician's view from the clinic, th
scientist's view from the lab, the parent's view from the nursery, or th
investigator's view from reading the latest research. The knowledge and wisdom
of all those players inform the chapters, synthesized and interpreted for th

curious new parents and caregivers eager for this information.

A report by the National Research Council and Institute of Medicine c children and brain development, published in 2000, became my starting poin The report's conclusions have rippled through every aspect of science, medicin and education and into family homes. This report, *From Neurons t Neighborhoods: The Science of Early Childhood Development*, says, "Althoug there have been long-standing debates about how much the early years reall matter in the larger scheme of lifelong development, our conclusion unequivocal: What happens during the first months and years of life matters a lo not because this period of development provides an indelible blueprint for adu well-being, but because it sets either a sturdy or fragile stage for what follows."[2]

Readers will appreciate the distinction. Adhering to the best that science has t recommend during the fourth trimester does not present an "indelible blueprint since infants, babies, and children can and do overcome poor beginnings. But wh start them out by giving them a lot to overcome? Rather, let's do our best to se the stage for "sturdy" development by treating the first three months of life as th biological continuation of fetal development that it is.

New research has begun to change thinking, establishing the fourth trimeste as an especially vital time for laying down the very foundations of developmen Yet this excellent science is not without controversy, as currently interpreted b the popular media and various advocacy groups. Two particularly inflamed ho button issues are breast feeding versus formula feeding and cosleeping versu sleeping alone. Acknowledging a variety of opinions on these issues, the text stick to the research while recognizing that science is a leading factor, but not the *on* factor, in parents' decisions on feeding and sleeping arrangements. In th objective way, the book stands apart in providing a comprehensive survey of newborn's developmental needs while remaining intimate, personal, an nonjudgmental. It can help new parents—biological or adoptive, as well as othe who provide consistent love and attention to infants—make their own person decisions within the parameters of best practices.

The need for loving attention is a constant theme of this book. Each chapte also draws on personal interviews with prominent researchers, practitioners, an parents. These resources are documented in the text in sufficient detail for curious reader to pursue specific questions in the relevant literature.

The first three months of an infant's life need not be a mystery to bumbl through. It's a common joke that infants don't come with an operating manua This compilation of recent medical, biological, neurological, behaviora developmental, and social science research from the past two decades provide the basis for just such an operating manual. New parents can comprehend muc of what throughout human history has been inexplicable and, in the process, ge their babies off to the best possible start.

The book begins millions of years ago with the chapter "Evolution and th Primitive Brain of a Newborn." It is the natural starting point in helping paren and caretakers understand that the reason human infants arrive so unfinished

deeply rooted in our common evolution—beginning with the moment our homini
ancestors first stood and walked on two legs. Readers will understand why fort
weeks of gestation is both a biological imperative and insufficient for greate
brain development in the uterus. They will begin to see that all newborns nee
another three months, a fourth trimester, of uncompromisingly close connectio
to their mothers or an equally loving and attentive caretaker.

The remainder of the book is organized by first addressing how such a
immature brain influences infants' most basic needs: crying, sleeping, and eating
These behaviors deserve three distinct chapters since they are the source of ever
parent's most urgent worries. These three concerns are linked to each other jus
as communication is linked to need. Every newborn cry of life reminds us that th
human being isn't ready to be separated from the uterus. Food, warmth, soothin
movement, and comfort once flowed to her without effort. Now, she must signa
hunger, discomfort, and fear with a cry, at first her only tool of communication
Now, as she makes her transition from the womb to the world, each adu
response to her wailing demands is helping to complete the neurological wirin
vital for living. The comforting closeness so recently experienced by the fetu
continues as chemicals released by physical contact or close proximity to
mother, father, or caring adult help the newborn regulate sleep and arousal.
Food, passively received in the womb, now requires effort.

The best nutritional transition to the real world during the fourth trimester, a
evolution and biology make clear, is breast milk. A clear understanding tha
breast feeding is the most natural extension of pregnancy is an important startin
point for every birth mother as she makes her own decision. I balance that trut
with the reality that some women cannot breast-feed or don't want to. Adoptiv
parents, foster parents, grandparents, and all manner of attentive caretaker
cannot breast-feed. For them, formula is a perfectly adequate second-best choic
as they, too, help their newborn with the transition to life in the world by holdin
the infant closely, making eye contact, and touching him. What he has receive
without asking for during nine months in the uterus—food, soothing comfor
sleeping on his own timetable—must continue during the time of transition v
attentive response to his cries.

Even as the basic needs for soothing, sleep, and food are met, the senses ar
proving to be nature's first teachers. After addressing parents' most urgen
concerns, the book's next chapters delve deeply into sensory development-
sound, sight, and touch. (Taste and smell, scientifically studied in far less depth i
newborns and tightly linked to feeding, are discussed in the feeding chapter
Nothing in infant development happens in isolation, and these three senses ar
intimately connected to soothing, sleeping, and eating. But these senses eac
deserve a closer look. Babies recognize their mothers' voices at the moment o
birth because they've heard them in the uterus. Hearing these voices agai
during the fourth trimester is an important part of the transition, and newborn
turn to their mothers' voices more readily than to any others. (Though, in the cas
of adoptive parents or alternative caretakers, babies will soon recognize
consistent new voice and will turn to the voice they've come to know.) From th

moment of birth, infants are busy soaking up the acoustics of their surroundings.

Vision is less developed than hearing at birth, but newborns can already se shadows of eyes, edges of faces, and areas of high contrast. Newborns see bette than once thought, but the concept of “seeing” is complex, since vision consists multiple components—focus, contrast, three-dimensionality, color—all developin at varying rates. Furthermore, the areas of the brain that interpret what's comin through the eyes are not yet set up to register what's seen in the way adul understand vision. Yet astonishingly, the very act of seeing is exactly what babie need in order to sort it all out. Each flicker of vision is setting up neur connections that will eventually let babies see the full world around them. Th relatively slowly developing sense of vision carries infants forward from a place darkness in the womb into a world of light.

The sense of touch, influenced for forty weeks by the warmth of amniotic flui and the secure confines of the uterus, continues during this time of transitio through swaddling, cuddling, and stroking. The last fifteen years have seen a se change in understanding touch, both painful and pleasurable types. Simpl human touch—comforting pats in response to tears, smiles in response t contented moments—releases brain chemicals that calm the infant. On the othe hand, trauma and stress (abuse, neglect, pain) release a flood of neurochemical including cortisol, that can set a child up for future trouble.

There are coexisting truths about the development of the senses: infants com into the world highly immature and yet extremely capable of learning an communicating. Each sense, at its own stage of readiness at birth, interacts wit all the others to mold a brain that is forming the likes, dislikes, and ver personality of a new human being.

As the senses are developing brand-new connections in the brain, the body growing stronger. Neurological and physical developments are linked—these ar similar to the mind-body connections science now recognizes in adults. Just a every interaction with the senses is building better abilities to see, hear, and fee every kick is building muscles that will soon enable the baby to crawl, walk, an run. Biological mothers know that these early flailings begin during gestation, an many fathers have felt their force as they've laid a hand on a pregnant belly. A important chapter on physical development shows why the “exercise” begun i the womb must continue, with caretakers encouraging infants to vary the positions during awake time. Holding infants in various positions not onl strengthens muscles, but it also gives infants a view of the world from more tha one perspective, each view affecting the synapses being formed.

Almost universally, parents, regardless of their circumstances or limitations want to do the best for their children. But with conflicting advice from the media and with an array of books and toys promising smart and happy infants, parent can be confused about what course to follow. To put their minds at ease, a chapte on stimulation summarizes appropriate sensory stimulation. Loving attention t cries, along with soothing voices, comforting touches, eye contact, and closenes to the mother's body (or an equally loving caretaker's body) are the kinds

stimulation an infant needs. A view of a mother's face, a father's profile, the soun
of live voices, the touch of skin or flannel or tweed, the smells of healthy food
cooking, and the taste of milk are preparing infants for the inimitable world tha
envelops them. For millions of years, trees, grass, voices, music, cuddling
constant proximity to mothers, and loving human interaction have provided all th
stimulation infants need.

Finally, the book steps away from the newborn to delve into research o
parents. Physical and psychological studies examining the postpartum months a
experienced by mothers are extensive, and there are exciting new indication
that, just as human interaction is sculpting infant brains, those same interaction
are reshaping maternal brains. Research into fathers' health is fledgling, bu
science now knows that men, too, are susceptible to postpartum depression an
that welcoming a child into a family can be stressful for both parents.

The multiple lines of research upon which this book is based show that a wel
equipped brain is grown from the normal, simple, and readily available seeds
playful activity and loving parents and adults. The chatter of everyday lif
lullabies of love, and glimpses of blue sky through green branches surrounding
newborn are naturally programming language, art, music, math, dexterity on th
playground, and lifelong social skills.

This book will help put to rest the remnants of a century of cultura
misconceptions that still linger: infant independence, fixed IQ, and a substitutio
of quality time for quantity time.

Cultural norms, fading but not entirely gone, once encouraged parents to mak
their largely unformed infants partly independent from day one. Infants wer
expected to go it alone in their own rooms, to figure out how to soothe themselve
by crying themselves to sleep, to wait through hunger pangs for an appointe
feeding hour—or to eat more than they wanted, which, the parents could hop
would then cause them to sleep longer. About a hundred years ago, this approac
was encouraged by "male physicians who not only had never changed a diape
but had never—in any substantial way—associated with, or taken care of the
own infants," according to Dr. James McKenna, director of the Mother-Bab
Behavioral Sleep Laboratory at the University of Notre Dame.[4] Separating infan
from their parents was supposed to foster independent toddlers, children, an
adults, and this approach was practiced for decades. Current research shows tha
it has the opposite effect.

The mid-twentieth century was also a time when people believed intelligenc
was fixed, set in stone at birth. In the 1950s and 1960s, research began to ca
doubt on that assumption. We now know that a child's IQ is influenced greatly b
either environmental stimulation or environmental neglect.[5] Science now sees th
human brain in a kind of computer model: hardware delivered at birth, an
software continually programmed by experience. The programming begins a
birth at a breathtaking pace.

The 1970s introduced to popular culture the concept of "quality time." Parent
could be absent for long stretches of their infants' days, the reasoning went, a

long as they compensated for lost time by making every available moment c
togetherness count with joyful, stimulating interaction. The trouble is, brai
development doesn't take time off, and infants don't learn on a convenien
schedule. When it comes to time, infants need both quality and sheer quantit
There are no shortcuts. A parent or a consistent, loving caretaker must be ther
when infants need them. During the fourth trimester, that's all the time.

This book goes a long way in removing the cloak of mystery that has alway
surrounded the fourth trimester. It presents an original perspective on the perio
following birth, identifying it as a continuation of the period of development withi
the uterus and, simultaneously, an interval that helps infants make the transitio
to the world.

This fresh way for parents, educators, and health care workers to understan
newborns points to a difficult societal dilemma. Newborns require constant lovin
attention. That is a truth that must not be compromised by simple ignoranc
Evolution and biology clearly prefer the bond to be between the newborn and th
mother, though, as I've noted, infants can be well cared for by fathers, adoptiv
mothers and fathers, or other consistent, loving, attentive adults. This book poin
to the need to pay attention to infants twenty-four hours a day throughout th
fourth trimester. Coming up with policy solutions that are truly family centered
beyond the scope of this book. But as a society, we need to come up with way
—*paid* parental leave for biological and adoptive mothers or fathers or both, fo
example—to support young families by ensuring that every infant is able to spen
this crucial period of development held tightly in the arms of love.

Evolution and the Primitive Brain of a Newborn

Why Infants Arrive Unfinished

Blame Lucy. In the throes of labor contractions and delivery, remember that i was this 3.2-million-year-old human ancestor who first had the big idea to stan up and walk on two feet. Lucy is considered by many scientists to be the mother o humankind, and her skeletal remains, discovered in 1974, provided scientif evidence of one of the first upright walkers in our family tree.[1] From that poin onward, the human ability to walk on two feet would demand some reworking o the adult pelvis and a major overhaul of the birth canal. Those evolving alteration would, in all descendant female hominids leading up to *Homo sapiens*, introduce host of inefficient twists and turns, making the process long and painful fo mothers and a brutal challenge for babies.

Lucy's hypothetical offspring, no longer able to survive with the limite brainpower required to climb a tree or flee from danger on four legs, neede more time to grow a bigger brain in order to outwit predators. But a maximum o forty weeks' gestation is all that biology allowed our ancient ancestors an modern babies. They would need a fourth trimester of intense developmen experienced outside the uterus while remaining physically and emotionally boun to their mothers, just as they had been for the previous nine months. The tight f through that circuitous birth canal set absolute limits on how much brai development could occur during pregnancy. The additional brain growth require to keep the species thriving would have to happen outside the uterus, a astonishing amount of it occurring during the fourth trimester.

Modern human infants are at the receiving end of millions of years o evolutionary progress, but the tradeoff for upright walking has been immatur brain development at birth.

Walking on two feet has been a mixed blessing. Standing upright altered th entire skeletal structure, and the changes came with physical costs for males an females: flat feet, aching backs, and stiff necks. "Ultimately, every part of th human body had to change to adapt to bipedalism," says Dr. Wenda Trevathan evolutionary anthropologist at the University of New Mexico.[2]

Women and infants have suffered especially onerous consequences of upright posture. What was once a straight shot down a roomy birth canal in our fou

legged ancestors has evolved into something akin to an amusement park rid through the modern female pelvis.

Once humans had only two feet for mobility, they could no longer climb as we as, or run as fast as, the local lions and tigers and bears. Since then, they've ha to rely on brainpower to escape predators. The pressure for increase intelligence was on, and our ancient forebears began to grow brains far large than ever before. In fact, the human brain *had* to get bigger, or our species woul have died out. Those outsized brains, and resulting intelligence, began to chang the world.

As the human brain has grown in size during evolution, the additional brai growth needed for survival has had to take place after birth because there simpl is no extra room in the birth canal for a bigger head.[3] After roughly nine month in the uterus, emerge babies must, ready or not. Most aspects of brai development are delayed until after birth. “And that means the baby is a littl more *unfinished*, if you will,” says Dr. Trevathan. “The evolutionary compromise i that about 75 percent of human brain development takes place after birth.” That in contrast with the rest of the animal kingdom. Most animals are born with the brains about half developed, but today human infants are born with only 2 percent to 29 percent of their brains developed. And so, with a brain only about quarter of its necessary size, the newborn needs a fourth trimester o development, with comforts similar to those enjoyed in the womb preparing hi for life in the world.

THE BIRTH RIDE

The evolutionary compromise between the need for a large brain and the confine of a narrow birth canal continues with modern-day infants. They arrive extremel neurologically immature and completely dependent on adults.

Leading, in most cases, with a head that can accommodate roughly a quarter o the brain mass she'll eventually require, the fetus is forced to negotiate a series o turns aligned with the widest parts of the pelvis. The entrance of the birth canal widest from side to side. About halfway through, the orientation shifts abou ninety degrees, and the fetus must turn her large head to make it through. So th infant starts her journey facing her mother's side. Midway she must shift her hea to face her mother's back. As the fetus's head turns from facing her mother's sid to facing her back, she goes through a series of rotations as she passes throug the birth canal. Once the head has emerged, the shoulders must shift, so the bab turns her head to the side, rotating her shoulders so they, too, can make the tigh squeeze between pubic bones and tailbone.[4]

The average infant head is ten centimeters from front to back. It's little wonde that childbirth hurts, considering that the average woman's pelvic opening thirteen centimeters at its largest point and ten centimeters at its smallest point.

The quadruped ancestors of modern humans, with larger birth canals an smaller brains, once might have given birth in solitude—like chimpanzee

orangutans, and gorillas can. However, because of the revised size and position o
the human female pelvis, women need midwifelike assistance to give birth. If th
mother reached down to assist her own baby's birth, she would risk injuring he
baby by bending his back against the natural curve of the spine.

As a result, not only did human bodies change with upright walking, but societ
also had to change in ways that could accommodate the demands placed on th
mother by the baby. First, mothers couldn't deliver in solitude. Once here, babie
could not cling with hands and feet, so mothers had to use one arm to hold the
and, often, the other arm to quiet them when danger lurked. With hand
occupied, human females needed help. They needed fathers to stick around. On
of the profound consequences of evolution, including the amusement-park-rid
aspect of birth, is that it has forced humans to be interdependent and social. Ne
mothers need help in birthing their babies—whether from an obstetrician,
midwife, a father, or an unlucky cab driver—and then they need help in bringin
them up. In our modern society, that help often comes from a traditional source
fathers. But it also comes from gay or straight partners, adoptive mothers an
fathers, foster families, grandparents and other family members, and lovin
caretakers of all sorts.

FOURTH TRIMESTER BRAIN DEVELOPMENT

Scientists now know that the brain continues to change and grow, allowing for
lifelong ability to reorganize neural pathways based on new experiences. Tha
ability is called neuroplasticity.[5] But while recent discoveries suggest that ne
neurons are produced throughout life, it doesn't happen nearly as rapidly as
does during the nine months spent in the womb. Some 100 billion neurons for
during pregnancy. At birth, all those neurons are as yet incapable o
communicating with each other.

But nature has made sure that the neural circuits responsible for basic bod
functions are up and running at birth. Infants arrive with the most basic an
primitive operating equipment, under the control of the lower parts of the brai
During gestation, the basic architecture of the brain is laid down, beginnin
development soon after conception. That prenatal architecture eventual
includes the brain stem, or lower part of the brain, regulating the central nervou
system and cardiac and respiratory functions; the thalamus, two bulb-shape
masses above the brain stem that process and relay sensory information; and th
cerebellum, which coordinates motor movement. Those parts direct the infant t
kick, grasp, cry, sleep, root, suck, swallow, keep a heartbeat going, and manage
circulatory system. It's all primitive or immature, and the higher centers, those i
charge of emotions, intelligence, planning, and motor responses, are still waitin
to be formed, influenced by love, conversation, comforting touch, face
movement, sound—in short, the world he was born into.

The work begins almost immediately. Each newborn is busy developing neura
connections by laying down a network of dendrites, branched projections tha
receive signals of communication and pass them on with the aid o

neurochemicals. The connections formed are called synapses. During the firs
three years of human life, there is an unprecedented pattern of rapid synaps
formation. In fact, babies develop so many synapses there simply isn't room fo
them all, and those that aren't used go by the wayside. The ones that remain ge
more efficient at providing the information we need.

This is how it works. Neurons are cells specializing in sending and receivin
signals. A neuron in the eye gets its signal from light; in the ear, from soun
vibrations; in the nose and tongue, from molecules that bind to them; and on th
skin, signals come from touch. A message travels, via electrical signal, fro
neuron to neuron to the part of the brain specializing in, say, seeing, tasting, o
moving. Then the output side kicks in, sending an outgoing signal to the retina, o
the tongue, or a muscle, complete with instructions on how to move, extend, o
contract. So even as the brain is constructing a branchlike communicatio
network, it is also beginning to pare down the number of neurons in the brain i
order to ease overload, making experience key to wiring an infant's brain.

During that time, an infant's brain experiences sporadic bursts of activity tha
are known as exuberant periods. At the peak of one of these periods, the brain
creating 2 million new synapses every second, researchers estimate. These burs
of development happen at various times in different areas of the brain during th
first months of life and continue, though at a slower pace, through adolescence
During infancy, the new connections allow for color vision, the ability to grasp
and a strong attachment to parents. Each baby is sculpting a brain that
becoming truly human and uniquely his own.

Neuroscience has become adept at studying the tiny but interconnected cel
of the brain using brain-imaging technology. Going well beyond earlier scientifi
tools—such as observation, autopsies, x-rays, and EEGs—CT scans, functiona
MRIs, and PET scans create three-dimensional images of the brain and allo
scientists to analyze its chemical composition, its electrical transmissions, and th
blood flow through the brain. Through the use of such technology, we now know
that when babies are born, they come equipped with more neurons than they
ever need, and some, but not many, synapses.

The neurons are the raw material of the brain, and heredity determines the
number.[7] (Only recently has research begun to show that important areas of th
forebrain continue to produce new neurons into adulthood.)[8] But the infant brai
is in a remarkably unfinished state, with its billions of neurons that are unable t
communicate with each other. Those connections only begin to be formed as th
baby experiences the world and the love of parents and caretakers. Nature an
nurture go hand in hand as each sensory interaction adds to the wiring.[9] Th
number of synapses skyrockets during the first three months and beyond, for a
long as three years. At birth, an infant has about twenty-five hundred synapse
per neuron. By three she has about fifteen thousand synapses per neuron, o
some 1,000 trillion synapses—twice the number of an adult brain.[10]

It's too many, and the brain knows it, as it kick-starts a use-it-or-lose-
mechanism, a lifelong process that begins during the fourth trimester even a

new connections are being made. Synapses are refined and pruned to eliminat those brain connections that are not used, and to favor those that get use frequently.[11] Coo, cuddle, and comfort a baby, and the synapses responding t loving behavior will endure. Scream, neglect, or strike a baby—events that ar read by the brain as toxic stress—and the synapses responding to cruelty an violence will take hold. The brain pathways that are repeatedly used, even a early as the fourth trimester, are protected.

Caregivers' every interaction serves to support the scaffolding for infant developing brains, part of the crucial postfetal development period that acts as transition in getting them ready for the world. The earliest games of peekabo form neural connections for vision as faces come close to infant faces and the disappear. The first hushed baby-talk messages begin to wire young brains for th sounds of language, specifically their own native language. Each new neura structure allows for newer layers of increasingly complex structures. Parenta games, lullabies, verbal patter, and comforting touches all cause the newborn brain to vigorously form the connections that in turn increase the number c complex links needed for passing electrochemical messages from brai neighborhood to brain neighborhood.[12] All of this biological activity mingles wit every sound, touch, sight, taste, and smell that mothers, fathers, and caretaker provide. And since the environment is different for every infant, each newbor begins to be transformed into the irreplaceable baby parents have been waitin for.

THE CHANGE FROM STRANGE NEONATE TO ONE-OF-A-KIND BABY

The change from the newborn that a mother first held in the hospital, or th infant that was first handed to an adoptive parent, to the child that is a uniqu part of the family doesn't happen in the delivery room. It begins to happen durin the outside-the-uterus fourth trimester of development as worldly experience shape the developing brain. What for nine months was largely under the purvie of evolution and genetics now partners increasingly with culture an environment. Brain development becomes a product of a delicate balanc between nature and nurture, genes and environment. Most scientists agree tha the nature/nurture debate is over, and it's a tie, with each influencing the othe Genetic predispositions, while influencing brain growth, don't altogether dictat it. Non-genetic influences—neighborhood, parents, siblings, extended famil peers, school, and nutrition—are important in shaping who this special infant wi become. Both nature and nurture are important.

When a mother cuddles an infant, she affects the formation of neura connections. When a father hums a lullaby, the infant's brain responds b retaining the cells that feel the pleasure of the sound. Touching, comforting rocking, talking, and singing to babies provide exactly what they need to stimulat their growing brains. As the baby is exposed to her unique surroundings, remarkable thing happens. The brain activity resulting from environmenta influences causes synaptic connections—neuron to neuron—to get stronger. Th

next time she's exposed to a similar influence, her brain cells respond mor
quickly and strongly. Meanwhile, those connections that aren't needed fall away
This use-it-or-lose-it model is the basis for each infant's growing individuality.

THE NEWBORN IS PREPARED

With a brain only about one-fourth ready, babies land right smack in the middle o
a chaotic and messy real world. The soothing things the growing fetus had in th
womb—the peace to sleep, a controlled space for exploring her own movement
the comforting external movements of her mother, the familiar muffled sounds o
the household—have been abruptly snatched away. Parents and caregivers hel
with the transition by paying close attention to comfort. But modern science tel
us that, even though the world is confusing to newborns, they've got amazin
devices with which to begin sorting it all out, right from the very start.

Despite the newborn's extreme immaturity, he is well prepared. He has at hi
disposal an arsenal of tools for himself; and some he'll find himself using i
response to signals from mother, father, or caregivers.

Survival for an infant in the fourth trimester means being constantly close to
nurturing caregiver—to the soothing touch, sound, odor, and radiated warmt
provided by someone who loves and pays close attention. Newborns are natural
built and equipped by evolution to prefer their mothers, though adopted infan
have proven that their allegiance changes when it must. That closeness is a vit
part of the transition from womb to world. Human babies pick up on movemen
patterns, breathing sounds, and body heat, all of which begin to regulat
hormonal releases—melatonin to help manage the sleep-wake cycle and bod
temperature, and cortisol to regulate blood pressure, blood sugar, and immun
response.

The kinds of behaviors that come naturally to parents and caregivers aroun
the world are just what the baby needs. Rubbing and massaging her bac
stomach, or legs keeps the infant warm; stimulates respiration, digestion, an
elimination; and calms her down. Mothers naturally hold their babies most ofte
on the left side of their bodies, and babies love feeling the soothing heartbea
Mothers, fathers, and almost all adults talk in high-pitched voices when the
speak to babies, and they look their babies in the eye. They've been doing thes
things for millions of years—exactly the things that newborns crave.

Just as the colt is born ready to stand, a human baby is born ready to recogniz
another human face, the smell of her mother's milk, and the familiar sound of he
voice. It's precisely because human babies are so extremely neurological
immature at birth that they are exquisitely responsive to the body cues of adult
even to the point of matching the rhythm of breathing when they rest on
person's chest. Fetal life has prepared the newborn to recognize these cues fro
another loving body, and the familiarity helps to ease the transition of the fourt
trimester. Babies have been responding to those instinctive touches, smells, an
sounds since the first human put one foot in front of the other.

“We are all preemies at birth, relative to other primates. The baby is high

sensitized to gases the mother gives off," says Dr. James McKenna, anthropologis
and director of the Mother-Baby Behavioral Sleep Laboratory at the University
Notre Dame. "Every baby in the world—put them next to their mothers and the
all do the same thing. They root. They breathe differently. The baby is waiting t
respond to these kinds of things. They have come off a long evolutionary tree, an
they know what to do."[13]

Evolution, biology, genetics, and the environment all help to fashion one speci
baby, far better than anything parents might have imagined. But the deep well o
parental love won't be returned in kind. Not yet. Babies need that love, can
thrive without it; but at first, it's all an infant can do to handle the new work o
eating, breathing, and regulating her own heartbeat and digestion. She's not ye
ready to show any signs of returning the outpouring of love. It can seem lik
unrequited love, but the demands and frustrations of the first months do no
represent a failure of parenting. It's not personal. It's simply biology. Parents hav
waited for a baby, and they've been handed a mysterious, not-fully-forme
neonate. Patience. The baby's brain, from the moment of birth, is beginning t
mature, to figure out sleeping, seeing, hearing. It's part of the dance of life—he
cries, grimaces, and involuntary smiles encouraging a parental response an
paving the way for a two-way attachment.[14] In time, she'll begin to respond. An
one day soon, she'll smile, a reward making it all worthwhile.

WHETHER THEY KNOW IT OR NOT, PARENTS ARE PREPARED

Sometimes we describe newborns as "half-baked" or "almost finished." In man
ways this is true. Fortunately, nature, evolution, and three trimesters in the wom
have prepared your newborn to begin the transition to the real world during th
first three months outside the uterus. In these pages, readers will come t
understand the fascinating and rapidly unfolding body of research from biologist
neuroscientists, developmental scientists, evolutionary anthropologists, an
physicians that both explains why this new human being is so unformed and lay
out what he needs during the fourth trimester. Parents, caregivers, and healt
care workers will gain confidence in knowing that, just as infants are equipped-
with massive help from adults—to handle the transition to life outside the woml
these adults, too, are naturally prepared to provide exactly what babies need.

Armed with knowledge of the natural workings of infants, parents will be abl
to sort through the advice and opinions of friends, family, physicians, and a $10
billion-baby-product-marketing industry that tries to convince people that the
products will make babies happier, calmer, and most assuredly, smarter.

This is not to say the work of the fourth trimester is easy. It isn't. Babies clearl
are not trouble-free. Indeed, there will be twenty-four-hour demands, and nigh
that feel like endless struggles. But with an understanding of infants' need
limitations, and development during the fourth trimester, new mothers an
fathers can begin their steady march down the parenting path with a maximu
amount of self-assurance and a minimum amount of fear. As an understanding o
one's mysterious newborn grows, so will the confidence needed to make th

hundreds of daily decisions that will influence her growth and development.

Each healthy newborn is ready to begin this fascinating journey And eac loving parent and caregiver, too, has what it takes to confidently provid everything a baby needs.

sample content of The Fourth Trimester: Understanding, Protecting, and Nurturing an Infant through the First Three Months