

motivations. The different symptoms have been associated with different brain alterations. No single region has been implicated to suggest that there is a region devoted to “self-awareness.” The data provide a philosophical conundrum. How can an unconscious disorder be “non-organic?”

– JOSEPH H. FRIEDMAN, MD

### Disclosure of Financial Interests

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Conflicts: In addition to the potential conflicts posed by my ties to industry that are listed, during the years 2001-2009 I was a paid consultant for: Eli Lilly, Bristol Myers Squibb, Janssen, Ovation, Pfizer, makers of each of the atypicals in use or being tested.

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## Ancient Speculation On the Seeds of Pestilence

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**Most noteworthy scientific discoveries represent dramatic** departures from prevailing dogma, courageous leaps into unexplored territory. But the germ theory of disease is not one of those quantum leaps. Without lessening the seminal contributions of Louis Pasteur (1822 – 1895) and his coworkers, it must nonetheless be recognized that many prior thinkers, centuries before Pasteur, had envisioned the possibility of an invisible *something* that was transmitted from the already-sickened to those about to fall sick; that some agent – if not visible at least corporeal – accounted for the dynamics of communicable disease. Many speculated over the centuries, but it was Anton Leeuwenhoek (1632 – 1723) who provided the instruments to observe these erstwhile invisible creatures and Louis Pasteur who provided the incontrovertible proof of their vital role in the causation of many human ailments.

In the absence of suitable scientific instruments, how might a physician in the year 180 CE explain the phenomenon of a contagious disease? He will observe, first, that certain diseases such as phthisis (tuberculosis) or ophthalmia (trachoma) readily infect those who come near while sufferers of dropsy or apoplexy do not seem to convey their ailment to others solely by proximity. An analogy was made to the phenomenon of magnetism: those things proximal to the magnet were attracted while those more distal were not. Still, how does the contagion get to be transmitted from one human to another? What specifically is being transmitted? Something physical? Or metaphysical?

This hypothetical physician's thinking must then confront an ontological question: Is the disease initiated by divine intent or by earthly cause? If it is caused by celestial intervention, then the ailment lay beyond the physician's earthly remedies. And so his thinking then gravitates toward the alternative: that the contagion is incited by a secular mechanism.

If earthly, might it be in the form of a vapor, such as the putrid mists emanating from swamps? Certainly the idea of morbid vapors – called miasma – causing malaria (Italian for bad air) was a widely accepted etiologic premise. To cite Lucretius (99 – 55 BCE), “When the deadly seed flying about the atmosphere come together, the air putrifies and becomes dangerous.” Three centuries earlier, Thucydides (460 – 395 BCE), historian of the plague of Athens, accepted that “The circumambient air carries certain seeds of plague” and presumed, further, that breathing in the putrid exhalations of

swamps and dead bodies produced the hot pestilential atmosphere that provoked the great plague.”

So the mists of the evening, generated by swamps, yielded bad air. But what was the inherent badness in bad air? Was it something spiritual (as in “Satan's pestiferous breath”) or something particulate? And could invisible things still be particulate?

Marcus Varro (116 – 27 BCE) was more specific in his speculation. He declared that “swamps bred invisible animalcula (*animalia quaedam minuta*) which on being breathed through the nose and mouth cause disease.” Certainly a wild hypothesis singularly free of any supporting evidence.

Claudius Galenus, known as Galen, was born in 129 CE in the Greek colony of Pergamon in Asia Minor. He was the son of a wealthy contractor who spared no expense in seeing that Galen was well-educated in philosophy and eventually in medicine. Galen traveled widely, wrote extensively, lived through the great Antonine plague, was personal physician to both gladiators and Roman emperors including Marcus Aurelius, and was Europe's most authoritative physician for over a thousand years after his death.

Galen wrote extensively, and reflected deeply, on the nature of contagion and the mechanisms underlying the spread of pestilential diseases; and further, whether this represented a tangible – if invisible – seed; or, alternatively, whether it was a miasma, a formless but deadly vapor which attacked all who inhaled its miasmatic poison. He favored the idea of a particulate seed, but it is not clear whether he construed “the disease seed” as a literal entity or merely a figurative metaphor. Galen went a step further proposing that the development of a disease required both the initiating seeds as well as a systemic alteration making the human more receptive, more vulnerable to the workings of the invasive seeds. Galen envisaged various environmental influences, such as excessive consumption of wine, as predisposing factors.

When working with ill-formed ideas and groundless speculations – and in the absence of substantive observations – scientists tend to seek analogies and metaphors. And in their gropings to explain why some fevers seem to be transmitted from person to person by proximity, they sought out happenings in their daily lives that bore a resemblance to the transmission of pestilence. The seed, an inconspicuous little

object, came to mind as a fitting metaphor since it is a living thing which, under appropriate circumstances, grows into something quite mammoth. And some courageous thinkers bestowed animal life to this hypothetical seed, referring to it as an animalcule.

Thus did thinkers, from poets to physicians, think of the possibility—just the possibility—that there exists a world of invisible things; and that populating this world are microscopic creatures capable of corrupting the human body in a phenomenon called contagious disease. Two millennia ago Pliny (23 – 79 CE) wrote: “Nature is to be found in her entirety nowhere more than in her smallest creatures.”

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## **The Ecology of Neonatology In Rhode Island: Improving Care For Newborns**

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*“In the planning and designing of new communities, housing projects, and urban renewal, the planners, both public and private, need to give explicit consideration to the kind of world that is being created for the children who will be growing up in these settings. Particular attention should be given to the opportunities which the environment presents or precludes for involvement of children with persons both older and younger than themselves.”*

– Urie Bronfenbrenner <sup>1</sup>

**Neonatology has been making improvements** in short-term outcomes since its “infancy” as a board-certified subspecialty in the 1970s. Most remarkable are the improvements in the survival of the most premature and those born at very low birth weights. However, through the articles contained in this special edition, you will realize that those in newborn medicine are now looking beyond the individual infant in its acute, critical state to the newborn’s development over time.

The “father of Head Start,” Cornell University child psychologist Urie Bronfenbrenner introduced (also in the 1970s) a theory of the ecology of human development. His theory stretched the psychologist to look beyond the individual child to the systems that support a

child. His theory can be represented as a series of spheres or concentric circles expanding from the infant or individual child to those larger, like the school system and legislation. Within the representation of the theory the individual child is in the center, with the circles or systems defined as; 1) a *Microsystem* with direct interactions with family, siblings, and peers, 2) an *Exosystem* with extended family, parent’s work environment, mass media, neighborhood and school board, and then 3) *Macrosystem* with aspects of society such as the history, laws, culture, economic and social conditions. A 4th system is referred to as the *Mesosystem* which is the interactions or connections between Microsystems. Since the original introduction the theory has been refined to include a *Chronosystem* which captures the patterns of change over a person’s lifetime or sociohistorical across time (e.g. divorce in a family).<sup>2</sup> Bronfenbrenner was in essence moving the field of human development from the traditional one-setting approach towards a child-centered approach across all settings.

Similarly, in Rhode Island we in neonatology or newborn medicine are approaching the improvement of neonatal outcomes across many settings and for longer periods of time. (Figure 1). For example, you could look at the construc-

tion of the new (**Neonatal Intensive Care Unit**) NICU as a direct intervention to improve the infant’s first *microsystem* with its family-centered approach. From here you can look at our developmental interventions with their emphasis on touch and complementary modalities as strengthening the skills of a family to meet the individual child’s needs, but also as strengthening the *mesosystems* relationships between medical care and the family. Teaching these care-augmenting techniques and skills brings to mind a statement by Bronfenbrenner that, “No society can long sustain itself unless its members have learned the sensitivities, motivations, and skills involved in assisting and caring for other human beings.”<sup>3</sup>

In this special edition you will see an example of how *macrosystems* with legislation developing the state-wide systems-based approach to hearing screening can directly impact the child. You will read about our use of the latest simulation technology to improve delivery of care, to diagnosis problems areas, to establish new processes, and to train staff, before our big move. Then finally you will read how we are continuing to follow these smallest and most vulnerable newborns over the course of their childhood, as they transverse their expanding ecology, and then using this information to improve the acute care we