Prenatal Tobacco Exposure: Perinatal & Genetic Risks

Primary Investigator: Kimberly Andrews Espy, Ph.D.
Funding Agency NIH, National Institute on Drug Abuse

Many women use tobacco during pregnancy, yet little is known about the effects of prenatal tobacco exposure on early human developmental outcome. It is known, however, that prenatal tobacco exposure is the single largest preventable risk factor for low birth weight and prematurity, both of which result in increased health-care costs.

Nicotine acts on the developing fetal nervous system directly through effects on neurotransmitter systems and indirectly by vasoconstriction of placental blood flow.

This study examines the effects of prenatal tobacco exposure as a function of perinatal and genetic risk, while accounting for social environmental effects. The purpose of this project is to better characterize the effects of smoking during pregnancy on early behavioral development by using a well-controlled, prospective longitudinal design where the amount of smoking is measured carefully by biomarkers and by self-report.

A large sample of pre-term and full-term infants will be recruited.

Postnatal tobacco exposure, in addition to alcohol, caffeine, and other substance exposure, also will be measured. Outcome will be assessed repeatedly in the neonatal period, both in the hospital where the effects of postnatal exposure and social environment are minimized, and after discharge where these effects are more prominent. Multiple methods are used to assess different neonatal outcome domains, with instruments that capture age-dependent neurobehavioral skills and physical growth. Sophisticated statistical methods will uncover prenatal tobacco exposure effects on developmental processes, including level and growth rates.

Knowledge gleaned about dose-response effects and the moderating influences of prematurity and genetics can be used to improve prenatal counseling about the risks of smoking during pregnancy in order to ultimately reduce prenatal smoking and to advance public health.

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Effect of Breast Milk Factors and Antimicrobial Peptides in a Neonatal Rat Model of Necrotizing Enterocolitis

Primary Investigator: Ruth Mayforth, M.D.
Funding Agency: SIU Central Research Committee

Necrotizing enterocolitis is the most common gastrointestinal disease of premature infants. It is a life-threatening bacterial infection that can result in overwhelming infection, the failure of multiple organs and even death. It is one of the most significant unsolved problems in neonatal intensive care units. An episode complicated by severe infection can prolong a patient's hospitalization by $1\frac{1}{2}$ – 3 months.

Infants at risk for the disease include premature infants, those receiving formula rather than breast milk, and those not getting an adequate supply of blood or oxygen to the intestine.

Furthermore, premature infants are not able to fight infections well, due to the immaturity of their immune systems. This research is focused on enhancing a portion of the immune response called the innate immune system.

The hypothesis is that breast milk factors and other peptides and proteins with antimicrobial activity can be added to the formula of infants and prevent or limit the development of necrotizing enterocolitis. The research plan is to cause the disease in baby rats to see if they can prevent the disease by supplying antimicrobial peptides or proteins in the formula they are fed. Investigators will examine the intestinal specimens to see how it affects the immune cells and intestinal cells.

Discovering a way to prevent or limit the disease would have a profound effect on the patients and families, and on the cost of health care as a whole.

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Investigating the intra-axonemal control mechanism that regulates dynein arm activity

Primary Investigator: Gerald Rupp, Ph.D.
Funding Agency: SIU Central Research Committee

Cilia and flagella are hair-like structures that are virtually identical across a broad range of organisms. Dynein arms are protein structures extending clockwise from one tubule of each of the 9 doublet microtubules toward the adjacent doublet seen in the central microtubule complex of cilia or flagella.

In mammals, these organelles are found in a variety of different cell types. In the respiratory tract, for instance, these cell appendages comprise the primary line of defense against inhaled contaminants.

This study hopes to gain a better understanding of how these tiny organelles are regulated to generate the elegant movements that characterize them, in order to treat diseases that result in respiratory distress or some forms of infertility.

This research is targeted at understanding how the small molecular engines that power ciliary/flagellar motility are regulated. Recent evidence has made it clear that all of the control machinery is present within these tiny structures. The investigation hopes that by understanding the mechanisms by which the structures function normally, researchers can begin to make headway into understanding what goes wrong in certain disease states.

For more information about these projects, contact the Office of Research and Faculty Affairs at 217-545-7936.