The Peri/Postnatal Epigenetics Twin Study (PETS)

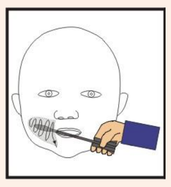
Why are we studying twins?

1. To study similarities and differences in epigenetics at birth and early childhood
2. To determine genetic and environmental factors that influence epigenetics
3. To discover how individuals with identical genes can develop differences in health, appearance and personality within pairs
4. We are particularly interested in how the environment in the womb affects how babies' genes act and whether their genes 'remember' this experience as they age

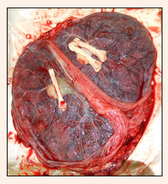
Tissues Collected At birth

Umbilical cord

Cord blood

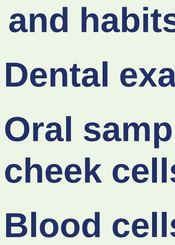


Cheek cells

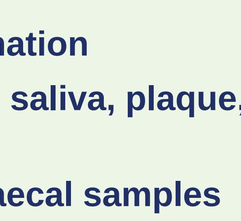


Placenta

Tissues collected at 18 months



Cheek cells



Blood cells

What is PETS?

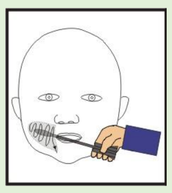
- 251 twins born between March 2007 and November 2009 and their mothers
- We recorded details of mothers diet and lifestyle during pregnancy
- Infants measured at birth and biological samples collected (below)
- At infant age 18 months: health information, measurements, cheek cells and blood cells collected
- Now age six years re-consenting: focus on links between oral, heart and gut health. Measurements, blood, cheek cells, and dental information collected

As we turn six

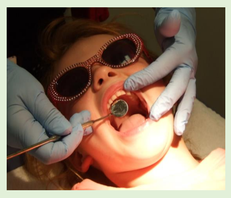
- To explore links between oral, heart and gut health
- Record details of diet, lifestyle and oral hygiene behaviours and habits
- Dental examination
- Oral samples: saliva, plaque, cheek cells
- Blood cells, faecal samples
- Anthropometric measures (height, weight, skin fold thickness, blood pressure, chest & arm circumference

Samples/data collected at age six years

Saliva



Cheek cells

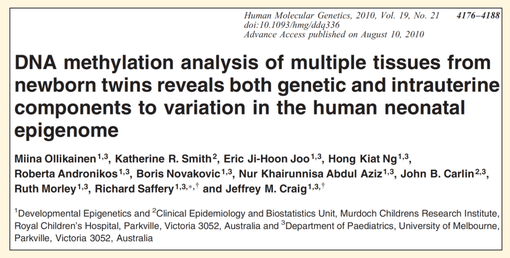


Caries & plaque

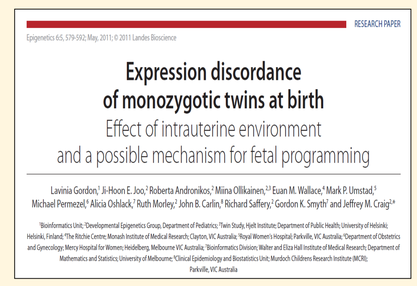
measurements

What we have found

1. When a specific epigenetic mark in 5 tissues in 2 genes involved in growth in 56 "identical" and 35 fraternal twin pairs was measured:
   - Genetically-identical twins can be born epigenetically different, meaning that they must experience different environments in the womb.
   - "Identical" twins are more similar epigenetically than fraternal twins, meaning that genetic differences can cause epigenetic differences
   - Different tissues have different epigenetic marks.
   - In unpublished work, we found evidence that epigenetics can be influenced by a mother's diet and by differences between the placenta and umbilical cords.



2. When activity of thousands of genes from cord blood and cells from umbilical cords from a dozen 'identical' twins were measured:
   - Differences found in gene activity within most pairs: epigenetics as well as DNA can make us different
   - Even though twins share the same womb, they can experience different environments before birth
   - Gene activity associated with difference in birth weight of twin pairs
   - These genes more likely to play a role in metabolism & cardiovascular function supporting the idea that environment encountered in the womb can "program" health and disease throughout life



   - Specific epigenetic mark at >14,000 genes measured in 3 tissues from 22 "identical" twins & 12 fraternal twins found "Identical" twins are, on average, more epigenetically similar
   - However, some "identical" twins are more epigenetically different than fraternal twins. This tells us that both genes and environment can cause twins to be different

The PETS team

Boris Novakovic, Eric J. Joo, Roberta Andronikos, Miina Ollikainen, Xin Li, Yuk Jing Loke, Hong Kiat Ng, Nur Khairunnisa Abdul Aziz, Anna Czajko, Yun Dai, Nicole Carson, Blaise Weinrich, Geraldine McIlroy, Ruth Morley, John Carlin, John Galati, Katherine Smith, Lavinia Gordon, Euan Wallace, Mark Umstad, Michael Permezel, Tina Vaiano, Sarah Healy, Bernadette McCudden, Nicole Brookes, Jennifer Foord, Pamela Leong, Richard Saffery, Jeffrey Craig

THE UNIVERSITY OF MELBOURNE

Murdoch Childrens Research Institute
Healthier Kids. Healthier Future.

The Royal Children's Hospital Melbourne