Immune system and pregnancy

Nine facts about pregnancy and the immune system

Why aren't fetuses rejected? How can pregnancy help certain conditions? How does breastfeeding help the baby?

1. The placenta is an immunological barrier between mother and baby

The placenta is attached to the lining of a mother's uterus as well as the baby's umbilical cord. One of the placenta's main jobs is to allow nutrients and blood from the mother to reach the baby – and it also disposes of the baby's waste back to the mother. The placenta produces hormones and also acts as a shield for the baby against bacteria but not viruses.

Once the baby is born, neither the mother nor the child will need the placenta any more. It is delivered by the mother after the baby is born in what's called the third stage of labour.

2. A mother's uterus should technically reject a fetus as foreign – but it doesn't

Our bodies are designed to detect foreign substances and attack them. These could include bacteria, viruses or a donated organ (if it isn't of the same blood type and tissue type). (See 'Rejection' for more.)

Each person has their own set of major histocompatibility complex (MHC) proteins – so why doesn't a mother's body reject her fetus, given that that the fetus's MHC is determined by that of the father as well as that of the mother?

Research published in 2012 that involved mice suggests that the reason a mother's body doesn't reject her fetus is down to signalling – particularly, a special type of signalling proteins called chemokines.

At sites of inflammation, proteins called chemokines recruit T cells as part of the immune response. In mice, the expression of genes that encode chemokines are switched off in the tissue around the fetus and placenta. This means that certain immune signals are turned off in the mother's part of the placenta, which keeps her body from attacking the baby.

Despite these protective mechanisms, pregnancies do not always reach full term (36 weeks). Some scientists attribute this to when the 'tolerance process goes awry', resulting in miscarriages, pre-eclampsia and preterm labour.

3. Pregnancy hormones can temporarily 'cure' some chronic conditions

Psoriasis, a skin condition characterised by red and crusty patches and silvery scales, affects both men and women. Treatment varies depending on the severity, and ranges from topical steroidal creams to light therapy to injected medications.

There is no cure for psoriasis, but some women have reported that their symptoms disappear when they become pregnant, which some scientists attribute to the 'steroid-like nature' of some of the pregnancy hormones.

Many expectant mothers with multiple sclerosis, a neurological condition in which the myelin that coats nerve fibres is damaged, also experience a relief in symptoms too, thanks to pregnancy hormones.

This reprieve is short-lived, though, say scientists publishing in 'Clinical Immunology', as the risk of relapse rises in the first three to four months after birth. These researchers are investigating whether there are any factors, such as breastfeeding, that could lesson the chances of a relapse.

4. Other chronic conditions may improve during pregnancy

Rheumatoid arthritis is a chronic condition that pregnancy can help 'treat'. Scientists have been aware for over 25 years that the condition improves in pregnant women. Currently 3 in 4 pregnant women with rheumatoid arthritis experience some relief in symptoms, with some going into full remission (where the disease goes away completely).

What's different from the cases of multiple sclerosis and psoriasis is that scientists do not think that hormones are at work here, though they aren't completely sure what is going on. One theory is that because some signals are turned

off in a mother's body – so that it doesn't attack the fetus – the overall immune system is less active against other agents as well. This is known as 'immune mediation'.

5. Breastfeeding can boost a baby's immune system

Once a baby is born, it no longer has the shield of its mother's placenta to protect it. One way to help guard a baby from infections and other diseases is breastfeeding. This is true across the world, but especially so in places where drinking water is contaminated. This is because powdered baby formula has to be mixed with water before it is fed to a baby.

The World Health Organization recommends that mothers breastfeed exclusively (this means giving your baby only breastmilk – no other food or water) for the first six months of the baby's life. It's not a six-months-or-nothing decision, however – any amount of breastfeeding offers some benefit.

Research has shown that breastfeeding can reduce the occurrence of severe diarrhoea and vomiting, chest and ear infections, constipation, and eczema. There is even research suggesting that breastfed babies are less likely to become obese, and therefore less likely to have obesity-related illnesses, later in life.

6. It can be a problem if a mother's and baby's blood types are different

You might know your blood type in terms of the ABO system, but do you know if your blood is Rh negative or Rh positive? Your Rh (formerly known as 'Rhesus') status is determined by whether or not you have the Rh D antigen on the surface of your red blood cells. Read more about this in our article on the history of blood types.

Trouble occurs, however, when a woman with Rh-negative blood is carrying a baby with Rh-positive blood, which can be inherited from the father. If the mother has been sensitised to Rh-positive blood (for example, by carrying an Rh-positive baby before), her antibodies will begin attacking and destroying her baby's blood cells during the pregnancy and even in the few months after childbirth.

This can cause the baby to have anaemia (iron deficiency) and jaundice, which occurs when the liver fails to process excessive amounts of bilirubin, produced when red blood cells break down.

Women are tested early in pregnancy to see whether their blood is Rh positive or negative. The baby's blood type can be checked at around 12 weeks of pregnancy. If the baby's blood type is positive, treatment may need to begin before birth for rhesus disease.

7. A vaginal delivery can be beneficial for a baby's immune system

A baby's gastrointestinal (GI) tract – which runs from the mouth all the way down through the intestines to the anus – is sterile when it is inside the uterus. Once the baby is born, its GI tract will be colonised with various microbes, building up a community of bacteria inside its gut that is known as gut 'microflora'.

This infant microflora contributes to health in many ways, say scientists: by supporting the digestion and absorption of carbohydrates, by interacting with the developing immune system, and by staving off diseases such as inflammatory bowel disease.

A vaginal delivery can help speed up this process. Babies that are born vaginally often have strains of bacteria from the mother's intestines in their oesophagus and stomach. (Yes, that's right, some of her poo in their stomach.)

While that may not sound like such a good thing, it can be helpful to be exposed to these microbes so quickly. Although babies born by C-section (Caesarean section) are also exposed to bacteria from their mothers and the environment, it can take as long as six months for them to establish the bacterial contents of their guts, whereas for babies born vaginally, it can take up to one month.

8. We can prevent the transmission of HIV from mother to child

Human immunodeficiency virus (HIV) can be passed from a mother to a child during pregnancy, labour or breastfeeding. According to the World Health Organization, mother-to-baby transmission rates when there is no doctor/midwife intervention are between 15 and 45 per cent. With the right intervention, however, this can be reduced to 5 per cent.

Whether a pregnant woman takes anti-HIV medication during her pregnancy depends on her viral load (the number of virus particles in a millilitre of her blood).

During childbirth, HIV-positive women are often given a medication called zidovudine, which passes quickly from mother to child. This drug helps to deal with any HIV particles that may get into the baby's system during delivery. Zidovudine is given on top of a mother's normal anti-HIV medication – or even if she did not receive any medication during pregnancy – to reduce the risk of transmission.

If the risk of transmission is deemed too great, a woman may be scheduled for a C-section instead of a vaginal delivery. US guidelines state that a C-section should be used when a mother's viral load is greater than 1,000 virus particles per millilitre – or if the viral load is unknown.

9. A mother can get the whooping cough vaccine to provide protection for her baby that lasts after birth

It would be great if mothers could pass to their children the immunity they have acquired from vaccinations – it would save quite a few jabs early in life.

But vaccinations are an example of artificial active immunity, which develops when your immune system comes into contact with the infectious agent. On the other hand, maternal antibodies are an example of natural passive immunity. Active immunity means making your own antibodies – and your body learning how to make more of those antibodies down the line if you need them. Passive immunity involves antibodies that come to you from another source.

Whooping cough, or pertussis, affects very young babies, and if it's severe enough, it can kill them. Ideally, babies would have a vaccination at birth, but their systems aren't strong enough to handle it until they reach eight weeks old. To protect them, the mother takes the vaccination between 28 and 38 weeks of pregnancy. This will give the baby just enough protection to last until eight weeks old. Many of the mother's antibodies will pass to the baby via the placenta during pregnancy, but they last only for a little while after birth.