Purpose: *To introduce the research of Dr. Odeblad.*
Instructions: *Please read these excerpts and answer the following questions.*
Relate your reading to what you have learned in FEMM.
(The full articles are available on the FEMM Learning Management site)

Dr. Eric Odeblad Cervical mucus and their functions
Journal of the Irish Colleges of Physicians and Surgeons, Vol.26, No.1, January 1997 27

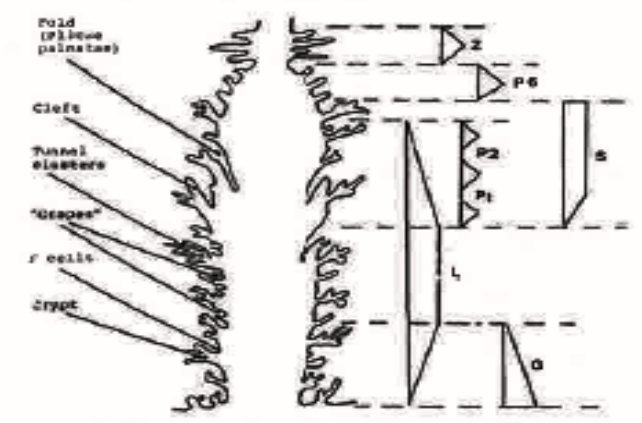

Figure 2: The principal anatomic structures of the cervix. Early epithelial growth gives rise to folds and clefts (the plicae palmatae). Later growth processes end up with 'grape-like' structures and crypts and tunnel clusters.

G, L, S the main types of cervical mucus
Two distinctly different types of single crypt mucus were characterized: G (crypts reacting on gestagenic stimulation) and E (crypts reacting on estrogenic stimulation). Following continued studies, the E-type was later divided into L-type and S-type mucus, the letters L and S referring to the shapes of the 'rods', L =loaf-shaped, S = string-shaped, but S also stands for 'sperm conveying' mucus.

Further studies with microscopy showed that the G mucus always contained varying amounts of cells, usually much more after ovulation (G+) than before (G-).
Also, it was found that the L mucus was responsible for the typical 'ferning' pattern, while S mucus showed much more tiny crystals, often long, thin needle-like structures.

The integrated function of the various mucus types
The G mucus is present in the cervical canal in all phases of the menstrual cycle except during the fertile period and menstruation. It is a natural barrier to sperm, and the presence of leucocytes and lymphocytes and gamma globulins suggest that the G mucus is a protective substance. Its high viscosity and glue-like character make it also a mechanical plug closing the cervical canal, which is also narrowed during the infertile phases by the fibromuscular system in the cervix.

The L mucus has an intermediate viscosity and is secreted during the whole fertile period. An L crypt becomes finally filled with L mucus during the process of secretion, and then this 'pearl' or 'loaf' of the transparent mucus is expelled. Probably 30 or more such units are produced during the fertile period, forming rows of 'pearls'. These arrays of L mucus units form a flexible mechanical support for the more fluid S mucus which appears 1-3 days later than the L mucus. Another function

of the L mucus is to capture sperm which deviate from the S mucus during sperm ascent. When sperm enter into the L mucus, they have difficulty escaping. In this way, the L mucus acts as a filter for sperm with irregular or curved swimming trajectories.
Rapidly swimming sperm appear to propagate between the filaments and may reach an S crypt within 4 - 15 minutes. There may be a downward flow of about 15um/sec. within a 'string' of S mucus. This flow is essential because it gives an upwards orientation of the swimming sperm.
Accordingly, both L and S mucus cooperate to bring about an optimal sperm propagation to a crypt.

Sperm migration in the cervix
Sperm invade the S mucus strings at the external os and propagate along the strings. A few of them may find the way directly to the uterine cavity, but the majority of sperm is conveyed to the S crypts. In the S crypts they seem to reduce or lose their movements, and they may 'hibernate' for a few hours to some days. The average time is about 20 hours. When the sperm come into the crypt, the S mucus secretion rate seems to diminish or disappear. Some women who want to conceive have even noted a temporary decrease of the slippery secretion during the day after intercourse. The mechanism(s) which lead to the sperm immobilisation and inhibition of secretion are not known, but some kind of neural factor can be expected. After a day or so, spermatozoa are released from the crypt and begin to propagate and find their way to the uterine cavity.

Dr. Erik Odeblad Investigations on the physiological basis for fertility awareness
Bulletin of the Ovulation Method Research and Reference Centre of Australia, Volume 29, Number 1, March 2002. PP 2-11

The properties of mucus
When the estrogens begin to rise, the L-cells also begin to produce mucus. It has lower viscosity, and begins to descend through the vagina and reach the vulva.

When the L mucus exceeds 50% of the total mucus, the woman perceives the beginning of the fertile period as a change in the character of the vaginal outflow, usually to a wet, sticky sensation. The G mucus decreases steadily and, with increasing estrogens, the S mucus now begins to appear. When S mucus reaches the same amount as the L mucus, the woman notices a change in the character of mucus perception to a wet-slippery sensation. After still one or two days, the estrogen reaches a maximum, as also does the S mucus. … A contributing factor to this sensation is probably an increase of the mucolytic activity again. The mucus aggregates are broken into smaller pieces which makes the mucus much more lubricative. Mucolysis may in some cases be excessive. This results in a loss of continuity of mucus, the vaginal outflow becomes watery and loss of slipperiness and lubrication occurs.

Questions:
1. Which hormone stimulates the cervical crypts to produce G mucus?
   Which hormone stimulates the cervical crypts to produce E mucus?

2. What does the symbol G mean? At what times of the cycle is G mucus present in the cervical canal?

3. What are the differences between G- and G+ mucus?

4. What are the characteristics of G mucus? What is its function in a cycle?

5. E mucus is divided into 2 main types: EL, which stands for _____, and ES, which stands for _____.

6. Describe the structure of EL mucus and its function in the cycle.

7. What hormonal activity causes the production of EL mucus? What are the characteristics of EL mucus? When is a woman likely to observe this type of mucus, and what does it signal?

8. Describe the structure of ES mucus and its function in the cycle

9. What hormonal activity causes the production of ES mucus? What are the characteristics of ES mucus? When is a woman likely to observe this type of mucus, and what does it signal?

10. Why do EL and ES mucus cooperate?

11. What accounts for the differences observed within mucus types?

12. Odeblad uses ‘sticky’ as an attribute of EL, however FEMM includes ‘sticky’ (along with pasty, unchanging mucus) as a yellow designation. How does yellow relate to the observation of E & G mucus? What are some reasons for the observations of yellow mucus?

13. How is knowledge of the mucus types helpful in teaching women to monitor their health and fertility?