Colostrogenisis --THE MAKING OF COLOSTRUM

"Colostrum is the first mammary secretion that every mammal gives its newborn. It is produced by the mother for only a short period of time before milk is produced. It contains numerous compounds which affect more than 50 processes in the body, ranging from immunity to regeneration and growth of all types of cells."

Colostrogenesis, the formation of colostrum, and **lactogenesis**, the process which mammary tissue undergoes when changing from a non-lactating to a lactating state, are events associated with pregnancy that are controlled by a specific complex of hormones and influenced by physical factors associated with the mammary gland. In the cow, development of mammary tissue and its ability to synthesize and produce secretions is promoted primarily by **growth hormone** and its mediators, the insulin-like growth factors **IGF-1** and **IGF-2** and the transforming growth factors **TGF-beta 1** and **TGF-beta 2**. The process is regulated by a series of other hormones, one of the most important being **progesterone**, which attaches to special receptors on the cells lining the mammary gland and prevents them from secreting any fluids into the gland during most of pregnancy.

The formation of colostrum in the pregnant cow is initiated about 3-4 weeks before parturition (birth) when a limited amount of fluid is released into the developing mammary tissue containing small amounts of the growth factors and other transforming substances. These substances influence the appearance of **specific receptors** on the surface of the cells lining the mammary gland that will facilitate the transfer of materials from the mother's blood into the gland. The substances include, among others, the **IgG** (antibodies) necessary to convey passive immunity to the calf and various hormones and growth promoters required to induce development of the newborn calf. About **two weeks** before birth, the **receptors for IgG** become fully active. **IgG** from the mother's blood attaches to the **receptors** and is transferred via special vesicles through the cells into the fluid in the gland. The **IgM** and **IgA** found in colostrum are actually produced by cells (B cells) from the mother's immune system that have moved into the mammary tissue. These molecules are transferred into the fluid in the gland by a similar **receptor** mechanism. The additional **receptors** on the cells lining the mammary gland capable of transporting other substances become fully activated about **3-5 days** before birth.

About 2 days before birth, the hormonal balance begins to shift when the mother's blood concentration of **prolactin** and **glucocorticoid hormones** increases sharply, overriding some of the inhibitory effects of **progesterone**, initiating the production of **copious secretions** and switching on the ability of cells in the mammary tissue to **synthesize various substances**, including **lactose**. At birth, when the placenta is eliminated, **progesterone** levels fall dramatically in the mother and its **inhibitory control** of the secretions is removed. Simultaneously, a **protein-based substance** develops in the cells lining the mammary gland that essentially **blocks any further transfer** of substances from the mother's blood into the gland. The composition of the fluid in the mammary gland at birth is that of **true colostrum** and reflects the functional changes that have occurred in the gland up to that time; it a) has a **high protein** concentration, most of which is **IgG**; b) contains the **highest** concentration of **growth promoters**, other **hormones** and additional **metabolically active substances**; c) is **low** in **lactose** content; and d) is **rich** in **milk fat**.

After birth, one of the most influential factors on the composition of subsequent secretions is **physical removal of the fluid** from the mammary gland. The removal of even small quantities of fluid triggers the production of **copious amounts of secretion** from the cells in the mammary gland. Since the **transfer of biologically-active substances** from the mother's blood is **blocked**, replacement fluid will contain primarily substances synthesized by cells in the mammary gland and, thus, will be of a different composition than the fluid originally contained in the mammary gland at birth. This fluid is known as **transitional milk**. The more original fluid, which is **true colostrum**, removed, the more adulterated the residual fluid becomes with transitional milk. This becomes more complex since the

mother's system will begin to **reabsorb** certain of the **biologically-active substances**, including some of the **hormones and the immunoglobulins**, from the mammary gland back into her bloodstream within **6-8 hours after birth** of her calf. Therefore, the **composition** of the mammary secretions **changes rapidly** during the hours and days after birth so that there is a **continuous transition** from **true colostrum to mature milk**.

The only **unadulterated true colostrum** is, therefore, derived upon harvesting the **first milking from the mother** within six to 12 hours after birth and before the calf has suckled. To assure that calves receive sufficient quantities of high quality **true colostrum**, most dairy producers in the United States do not allow the calf to suckle its mother immediately after birth, physically remove the **true colostrum**, and feed the required amount by nursing bottle. The remainder of this material is what is then used to make colostrum powder and other products.