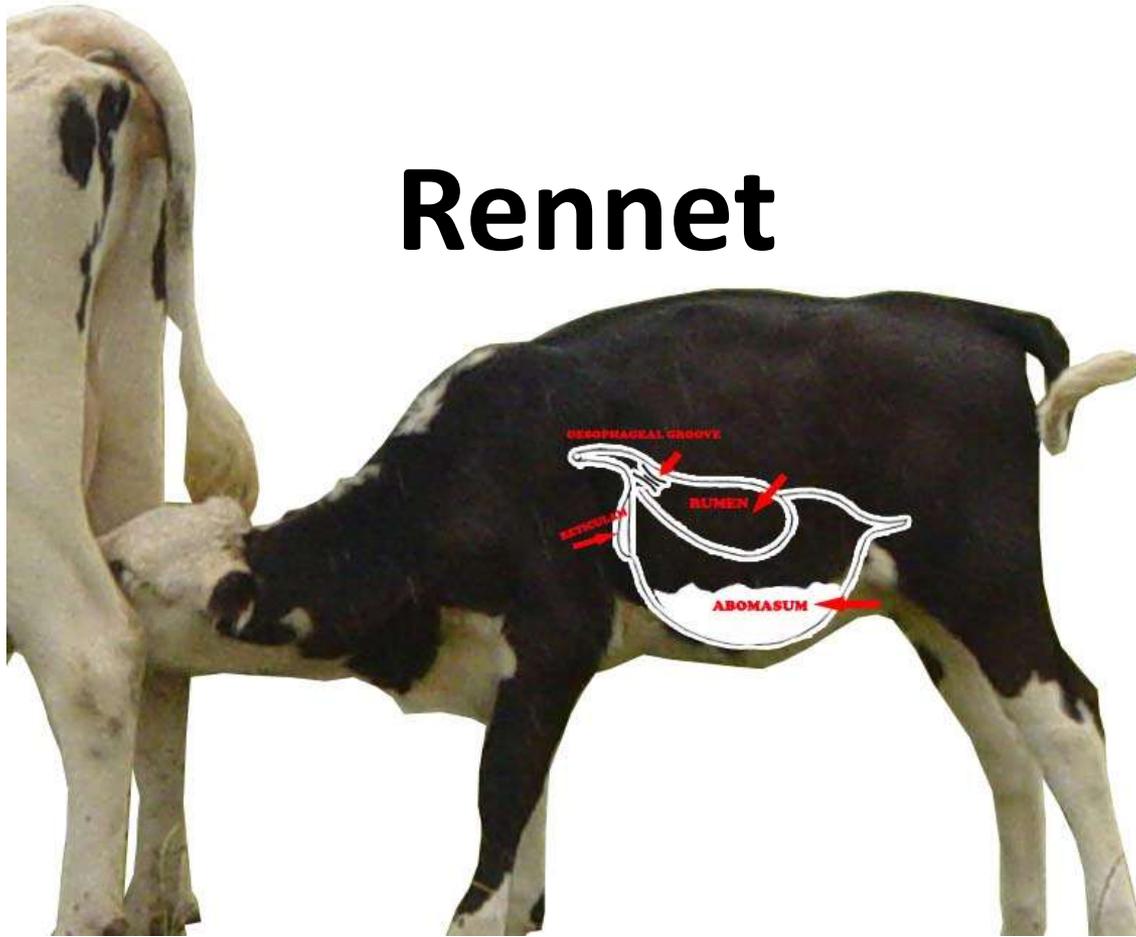


Rennet





Animal

Vegetable

Microbial



- ❖ Milk coagulation is a basic step in cheese manufacturing.
- ❖ Calf rennet, conventional milk clotting enzyme obtained from fourth stomach of suckling calves was used as coagulant in cheese making all over the world.

Desirable Characteristics of Rennet Substitutes

- ✓ **Ratio of milk clotting activity to proteolytic activity should be high. Milk should clot without much proteolysis i.e. breakdown of proteins to peptides. This prevents excessive nonspecific proteolysis during manufacture and hence protects against a weak gel structure and high losses of protein and fat in the whey.**
- ✓ **Should be thermally stable at pH and temperatures used during cheese making.**
- ✓ **Should impart desired flavor, body, and texture characteristics to the finished cheese.**

Milk-clotting Enzymes from Plants: Enzymes from many plant sources may be used as clotting enzymes in cheese making but plant proteases are strongly proteolytic and cause extensive digestion of curd, resulting in reduced yields and bitter flavors.

❑ **Papain:** Latex of plant *Carica papaya* yields papain and several other proteases. It has powerful milk clotting activity but it is also highly proteolytic.

❑ **Ficin:** Ficin is present in the latex of *Ficus carica*. Cheese made with ficin develops bitter flavor which decreases in intensity during curing.

Microbial Rennet

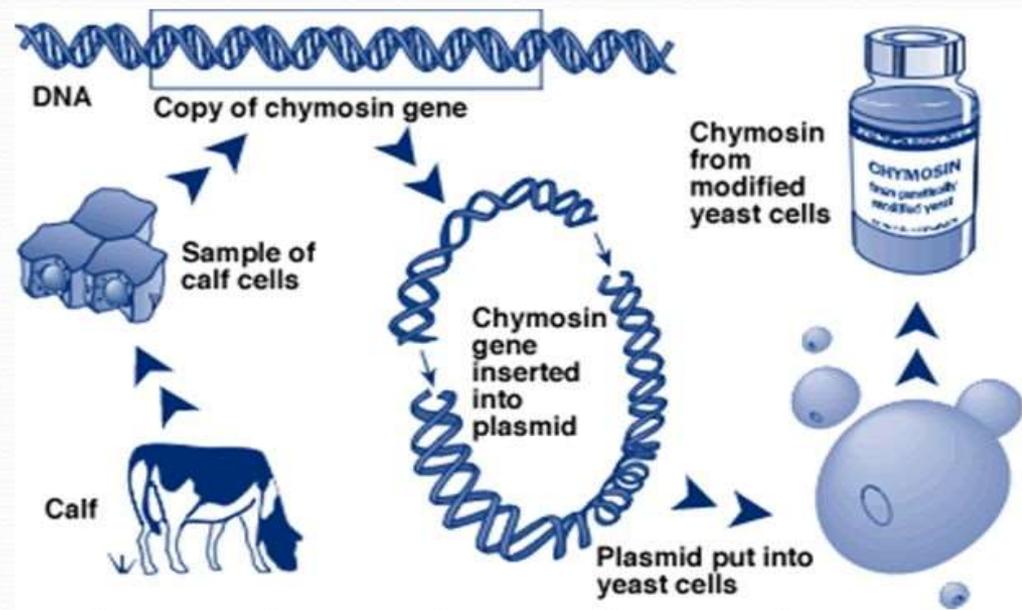
- ✓ Large number of microorganisms produce milk clotting enzymes.
- ✓ Microbial enzymes are known to exhibit considerable variations in the range of activity, substrate specificity and mode of action.
- ✓ Milk clotting enzymes from bacteria like *Streptococcus liquefaciens*, *Bacillus cereus*, *B. polymyxa* and *B. subtilis* have been used as coagulating enzymes.



Micoorganisms used in commercial production of microbial rennet

Name	Source of Enzyme
Hannilase	<i>Mucor miehei</i>
Rennilase	<i>Mucor miehei</i>
Fromase	<i>Mucor miehei</i>
Miki	<i>Mucor miehei</i>
Marzyme	<i>Mucor miehei</i>
Novadel	<i>Mucor pusillus</i>
Noury	<i>Mucor pusillus</i>
Meito	<i>Mucor pusillus</i>
Emporase	<i>Mucor pusillus</i>
Suparen	<i>Endothia parasitica</i>
Mikrozyme	<i>Bacillus subtilis</i>
Sure curd	<i>Endothia parasitica</i>

Recombinant chymosin



- ✓ Recombinant rennet/chymosin can be prepared by gene transfer technology in which the bovine chymosin is cloned in a suitable production strain and the enzyme is produced by fermentation.
- ✓ *E. coli*, *Kluyveromyces lactis* and *A. niger* var. *awamori* have been successfully used for production of calf rennet.
- ✓ Recombinant and highly pure chymosin has some other advantages (specific, low proteolytic activity and vegetarian approval).