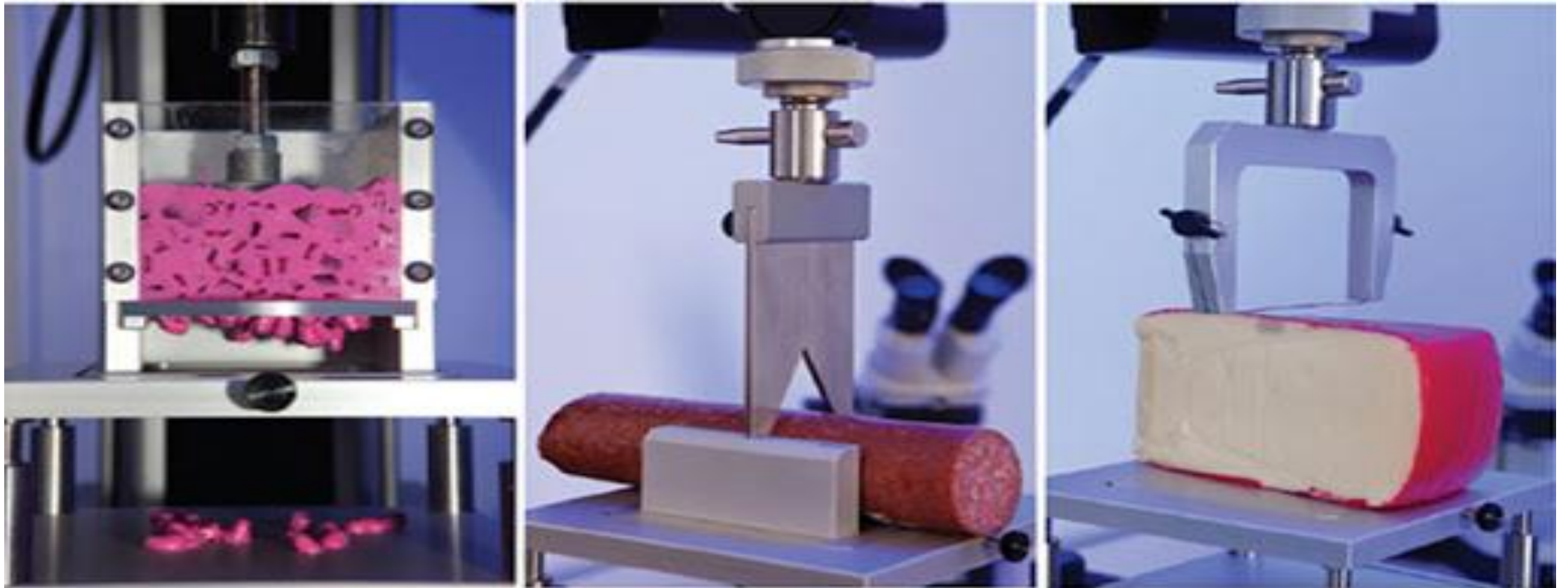


# Interrelationship between sensory properties of dairy products with instrumental and physico-chemical tests



- The texture properties of dairy products are that group of physical characteristics which are sensed by the feeling of touch and are related to the deformation, disintegration and flow of the product under application of force.
- While the subjective measurement of sensory properties is a limitation accomplished by the use of sense of touch or feel by the human hand and mouth, the objective measurements refer to measurement of the properties only indirectly.
- Despite certain limitations such as high cost, skilled operation, calibration of instruments the instrumental approach remains superior to subjective measurements as it offers sensitivity, reproducibility and versatility.

## TEXTURE AND ITS INSTRUMENTAL PROFILES:

- The textural properties of dairy products are greatly influenced by the internal structure, composition (protein, total solids), size and shape, and their interrelationships. It is, therefore, not possible to obtain an overall index of these properties in a single measurement.
- Measurements of texture generally measure force of work or both which are functions of mass, time and deformation. The following textural profile properties are often measured in modern texture analyses:
  - a. **Hardness:** The force necessary to attain a given deformation (peak force during the first compression cycle)
  - b. **Cohesiveness:** Threat of disintegration under compression strength (ratio of positive area during the second compression to that of first compression)

**c. Adhesiveness:** The work necessary to overcome the attractive forces between the surface of the food and other surface of contact (negative peak area for the first cycled compression)

**d. Elasticity:** The rate at which a deformed material goes back to its under formed condition, after the deforming force is removed. (The height that the food recovers during the time that elapses between the end of the first bite and start of the second bite)

**e. Gumminess:** The energy required to disintegrate a semi-solid food product to a state ready for swallowing (hardness & cohesiveness)

**f. Chewiness:** The energy required to masticate a solid food product to a state ready for swallowing (gumminess x springiness)

## TYPES OFTEXTURE INSTRUMENTS

## Wire Cutting Devices

A wire driven at a constant speed to cut the sample is used for certain dairy products. An advantage is that the sample area in contact with the wire is used in dairy industry to measure the curd tension of milk and fermented products like curd, yoghurt, cottage cheese etc.

A circular blade is driven at a constant speed to cut the curd. It is characterized by a product supply carriage, into which the guide for the material to be cut, the feed device and means for holding the material to be cut are integrated and can be switched over between operating position and a retracted position by means of an actuating unit. Thus permitting the product to be guided right-up to the immediate vicinity of the cutting knife.

## Wire Cutting Devices

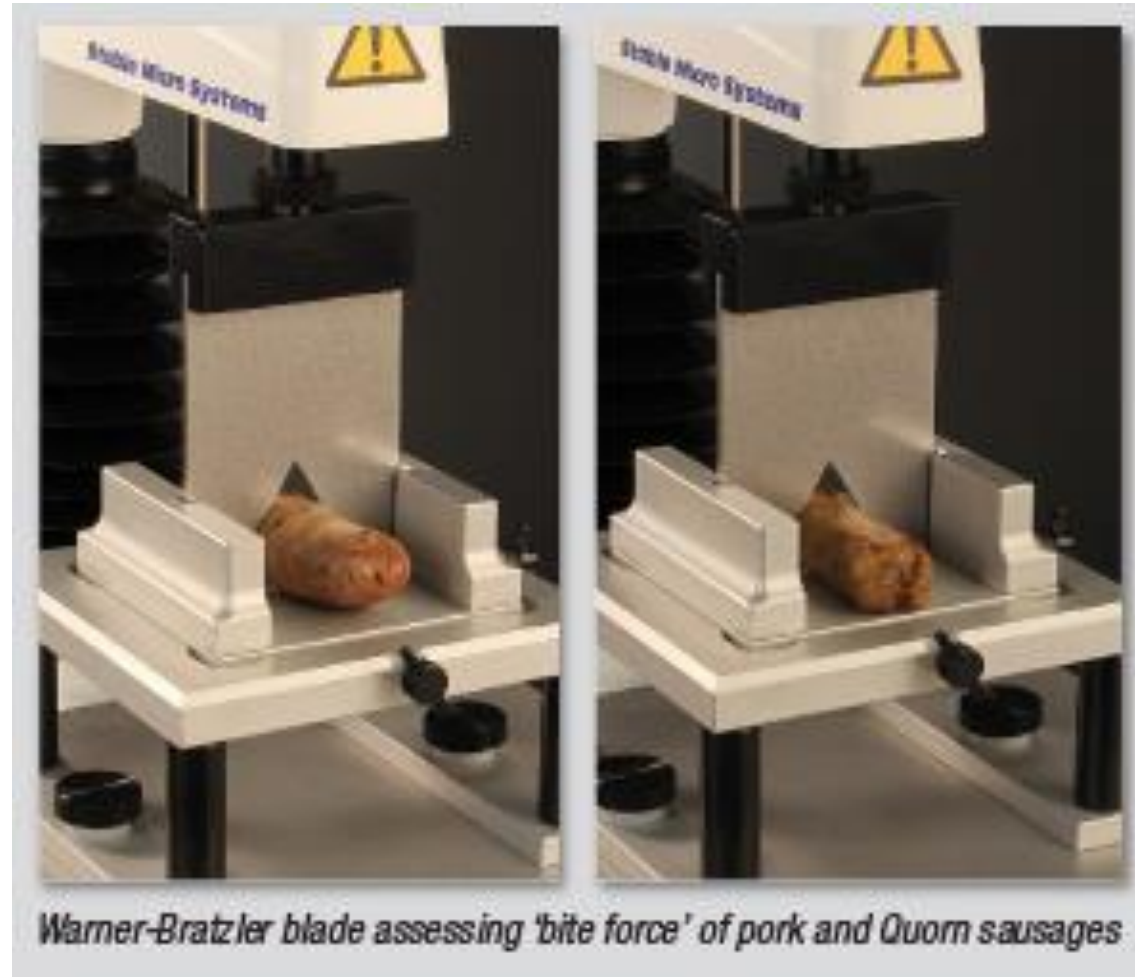


# **Warner – Bratzler Shear Tester**

In this tester, a cylindrical sample usually 2.5 cm. in diameter is placed in a triangular hole in a thin blade of 0.25cm thickness cut by pulling the blade through a slot and the shear force indicated by a spring scale. It is widely used for meat products.

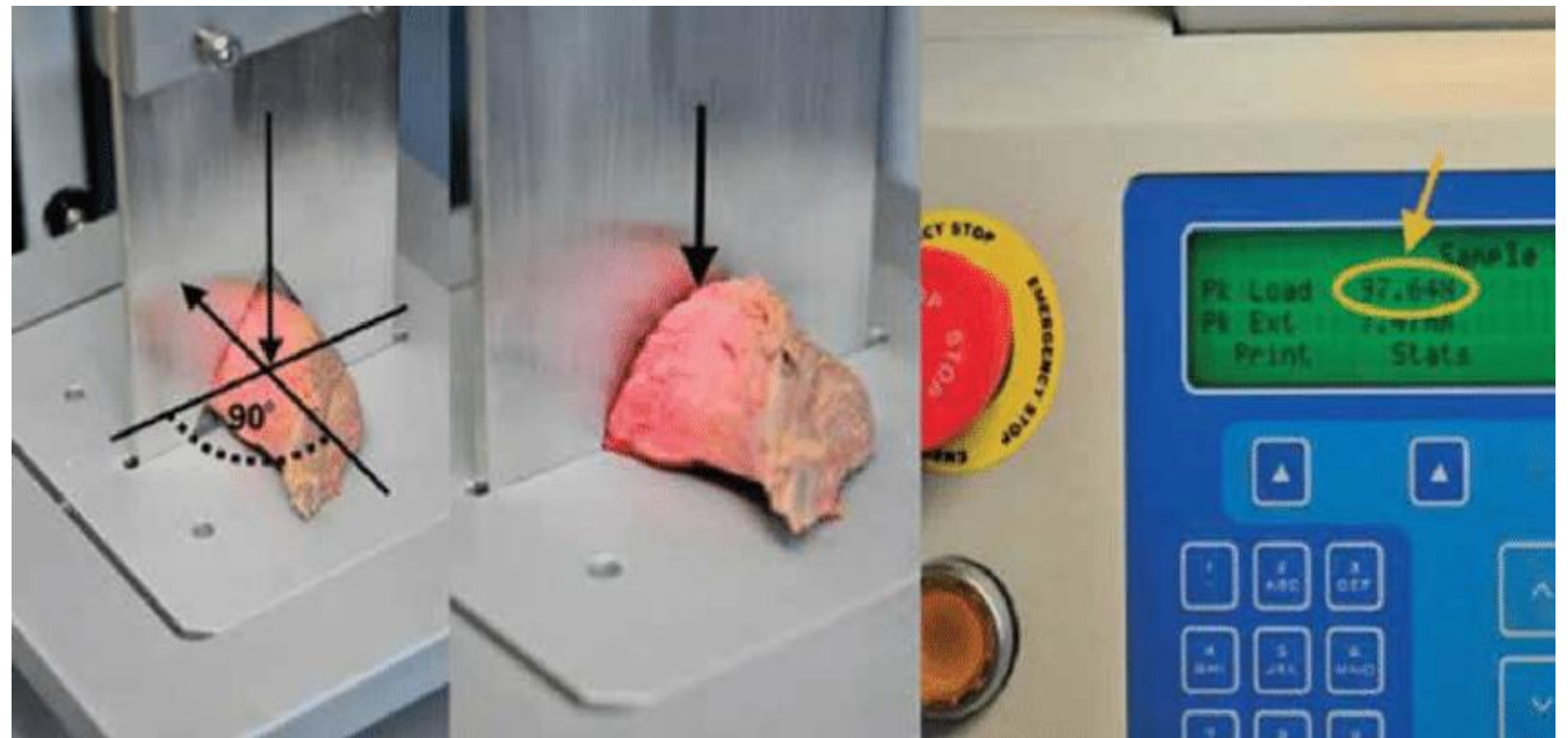


## Warner – Bratzler Shear Tester



<https://www.youtube.com/watch?v=miCCH50ArUc>

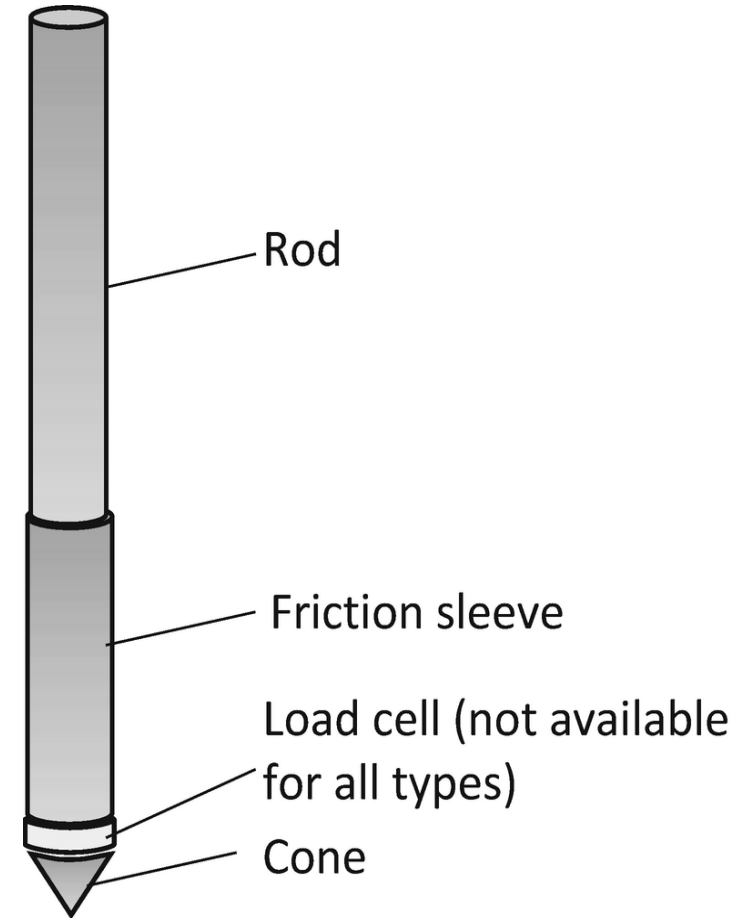
# Warner – Bratzler Shear Tester



# Cone Penetrometer

It consists of a cone of varying dimensions which is allowed to penetrate under constant conditions in chhana, paneer, khoa or any other soft dairy product. The hardness values are read out on a mechanical linked graduate scale in terms of one tenth of mm penetration.

# Cone Penetrometer



## **PeaTendero meter**

It consists of a grid of shearing blades (test cell) rotated at constant speed through a second grid suspended, so that the force on the second grid is counter balanced by a pendulum which is displayed by a pointer on a graduated scale. It is widely used by the pea industry.

## Pea-Tendero meter



## **Kramer Shear Press**

Kramer shear Press consists of a hydraulic press where the ram speed can be selected to complete its down stroke in 15 to 100 seconds. The ram operated by a hydraulic pump drives the moving components of the texture test cell into stationary components supported by the press frame. It is based on the principle of a multi – blade shear compression cell. The instrumental does not give precise and accurate reading of force exerted because of its limitation of control by ram speed.

# Kramer Shear Press



<https://www.youtube.com/watch?v=t1lgHtDR2a0>



# Instron Universal Testing Machine

- The Instron Universal Testing machine is an instrument for measuring texture through tension and compression testing within the force range of less than 1N to 5kN.
- It is a very important and versatile instrument for application in research, development and quality control laboratories.
- It comprises of a standard load frame and drive unit, a load weighing system and a micro processor based control system.
- A beam carrying a load cell (moving cross head) is located between the based unit and the fixed cross head at the top of the frame.
- The cross head moving in vertical direction at a selected speed is supported and driven by two lead screws.
- It contains a force sensing and recording system which measures the force during the test and transmits them to a strip chart recorder.
- This Instrument can be programmed for automatic return, cycling and relaxation test etc.

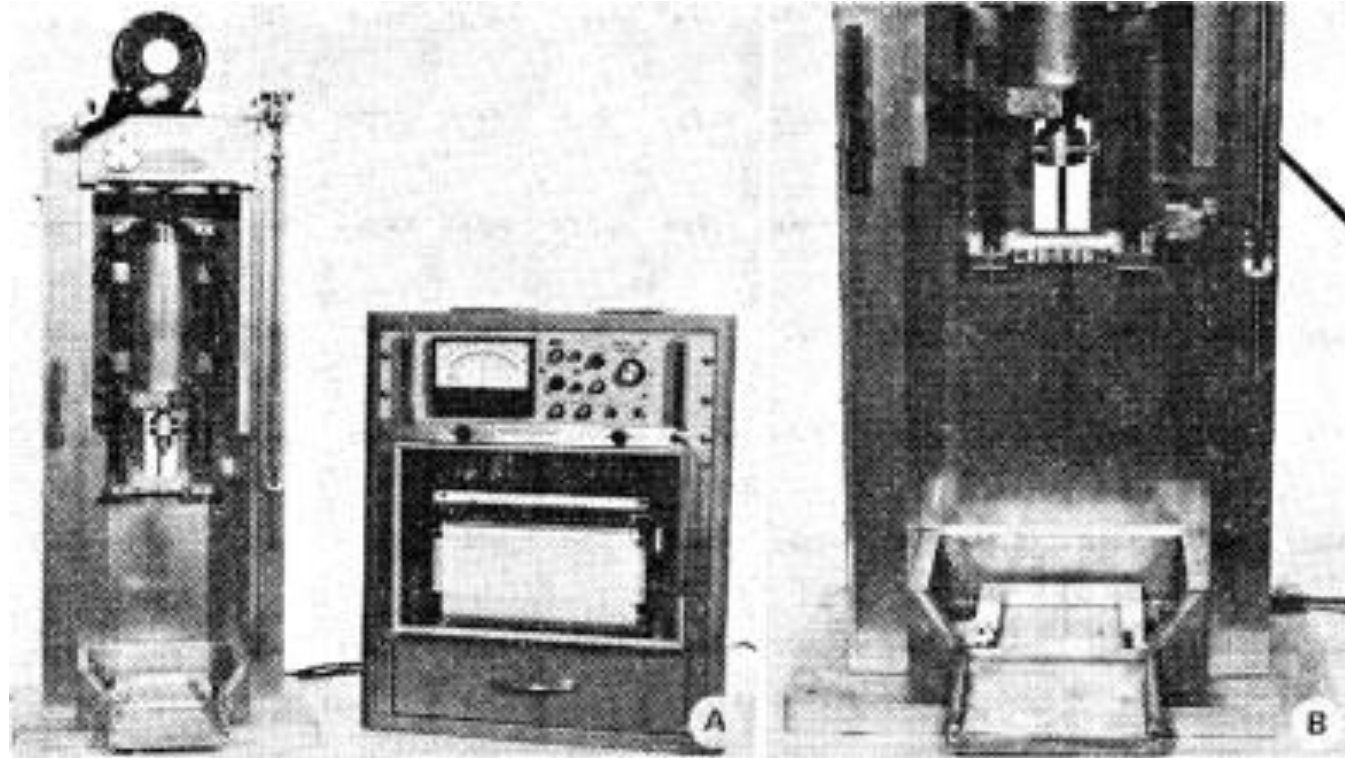
# Instron Universal Testing Machine



# The Ottawa Texture Measuring System

The Ottawa Texture Measuring machine is similar to the Instron Machine in design and operation except that it uses a single screw as drive instead of twin screws. The Ottawa cell consists of a rectangular metal box containing 8 or 9 thin stainless steel rods. The sample is compressed by a plunger and sheared and extruded through a wire – grid. It offers operational flexibility for research and quality control laboratories. It uses modern electronic system to record force, deformation and time precisely.

## The Ottawa Texture Measuring System



# General Foods Texturometer

The principle involve in the instrument is imitation of the chewing action of the mouth for mastication of foods. The chewing forces are detected by strain gauges with the help of a position transducer and displayed on an oscilloscope. This helps ascertain the force required for teeth penetration into the food, thus reflecting the food texture.

## General Foods Texturometer



# The Stretchometer

The instrument is used for the measurement of stretchability of Mozzarella cheese.



## **Other Instruments**

The curd tension, curd firmness, consistency/viscosity of cheese etc. can be determined by various techniques especially milk curdo – meter, containing a star shaped knife attached to a balance. Other texture measuring devices employed for milk products include ball and needle penetrometers, extenders, gelographs etc.