NEGATIVE ATTRIBUTES

(1) USING THE WRONG
    NON-MEAT PROTEIN

(2) USING THE INCORRECT
    QUANTITY AND TECHNOLOGY
DICED / MINCED

STEW
MINCED MEAT
BURGERS
WORS
RUSSIANS
MEAT BALLS

NON-MEAT PROTEINS

90% SOY ISOLATES *
70% SOY CONCENTRATES TEXTURED
50% TEXTURED SOY PROTEINS SOYA
90% CASEINATES CONCENTRATE
80% ALBUMIN
80% GLUTEN

POSITIVE FUNCTIONALITY

1. NUTRITIONAL
2. ECONOMICAL
3. WATER BINDING
4. FAT BINDING
5. UPGRADE QUALITY
6. INCREASE YIELDS
7. AFFORDABLE PRODUCTS
8. TEXTURE
9. CONTROL FRYING LOSS
NEGATIVE ASPECTS

1. TASTE
2. INCORRECT LEVEL OF USE
3. BAD TECHNOLOGY
4. INCOMPATABILITY

SOLUTION

** USE THE CORRECT INGREDIENTS AT THE CORRECT LEVELS!**
CHEAPER MEATS: OFFAL FAT; RINDS; M.R.M. 

COMMINUTED 
EMULSIFIED 

NON-MEAT PROTEINS USED:

1. VEGETABLE PROTEINS (SOYA)
2. ALBUMIN
3. CASEINATES
4. BONE PROTEIN
5. GLUTEN

POSITIVE FUNCTIONAL PROPERTIES

1. EMULSIFICATION
2. GEL PROPERTIES
3. NUTRITION
4. TEXTURE / SLICING
5. ECONOMICS
6. INCREASED YIELDS
7. IMPROVED QUALITY OF CHEAPER CUTS
8. INSURANCE AGAINST PRODUCT FAILURE

NEGATIVE ASPECTS

** USING POOR QUALITY PROTEINS **
CHEAPER MEATS: OFFAL FAT; RINDS; M.R.M.

COMMUNTED
EMULSIFIED

NON-MEAT PROTEINS USED:

1. VEGETABLE PROTEINS (SOYA)
2. ALBUMIN
3. CASEINATES
4. BONE PROTEIN
5. GLUTEN

POSITIVE FUNCTIONAL PROPERTIES

1. EMULSIFICATION
2. GEL PROPERTIES
3. NUTRITION
4. TEXTURE / SLICING
5. ECONOMICS
6. INCREASED YIELDS
7. IMPROVED QUALITY OF CHEAPER CUTS
8. INSURANCE AGAINST PRODUCT FAILURE

NEGATIVE ASPECTS

** USING POOR QUALITY PROTEINS **
CONCLUSIONS

BOTH MEAT AND NON-MEAT PROTEINS HAVE POOR QUALITIES.

THEREFORE, PROTEINS AND OTHER INGREDIENTS USED MUST BE COMPATABLE WITH THE PRODUCT, AND USED AT CORRECT LEVELS SO AS NOT TO CAUSE A DETERIORATION IN DESIRED / PERCEIVED PRODUCT QUALITY.
6. COMPOSITION OF SOYA PROTEIN PRODUCTS

6.1 Processing of soya protein products - Figure 5.

6.2 Categories of Soya Protein products. There are three categories of soya products classified according to their protein content. These are shown in Table 8, and can be seen amongst the ingredient demonstration.

Soya protein products have been defined by Codex Alimentaris, and accepted worldwide as highly nutritious protein products by The World Health Organisation (WHO), Geneva, Switzerland, in its recent report Energy and Protein Requirements (April 1986).

6.3 Compatibility and Functionality of Soya Protein Products

The versatility of soya protein products is clearly seen by the range of food products in which they are used as primary ingredients - Table 9.

Their functionality in meat products has been illustrated by demonstration of gels, emulsions and diced/minced meats.

6.4 Nutrition

This is a controversial area which is being slowly resolved by human studies as opposed to animal studies. At present soya product nutrition may be summarised as follows:-

| TABLE 10 |
| BENEFITS |
| COMPARABLE AMINO ACID PROFILE |
| LOWERS SERUM CHOLESTEROL |
| INEXPENSIVE PROTEIN SOURCE |
| VERSATILE IN MANY FOODS |
| WHO. ACCEPTABILITY |
| HIGH NPU |

| NEGATIVES |
| FLAVOUR PROFILE/TECHNOLOGY |
| ACCEPTABILITY BY CONSUMERS. STIGMA. |
| NUTRITION CONTROVERSY |
| COMPETITION AGAINST TRADITION |
| RAT STUDY NEGATIVES |
| ANTI-NUTRITIONAL FACTORS |
TABLE 8

TYPES OF SOYA PRODUCTS (PROCESSING)

(1)  SOY FLOURS AND TVP            50 - 69% PROTEIN
(2)  SOY CONCENTRATES              70 - 89% PROTEIN
(3)  ISOLATED SOY PROTEIN           90% PROTEIN

SOYA PRODUCTS AVAILABLE IN SOUTHERN AFRICA (COMPATABILITY)
FOR THE PROCESSED FOOD MANUFACTURER

SOYA FLOURS  * FROZEN TEXTURED SOY CONCENTRATES
(UNIQUE IN SOUTH AFRICA)

SOYA MEALS

SOYA FLAKES

SOYA TVP - (IN VARIOUS FORMS)

SOYA CONCENTRATES

ISOLATED SOY PROTEIN (ALMOST 20 VARIETIES WITH DIFFERENT FUNCTION)
TABLE 9

SOYA PRODUCTS AVAILABLE IN SOUTHERN AFRICA (COMPATABILITY)

INFANT FORMULAS

CLINICAL FEEDING FORMULAS

DIET POWDERS

SOY MILK DRINKS (FLAVOURED)

MEAT FORMULATIONS (POLONIES, VIENNAS), STEWS, MINCED MEATS)

PROTEIN ENRICHED BREAD AND BAKED PRODUCTS

CEREALS

SNACK FOODS (EXTRUDED)

FROZEN VEGETARIAN PRODUCTS (AT LEAST 10 VARIETIES)

DRY PRODUCTS (MEALS)

MEAT EXTENDERS

ICE CREAM (FROZEN DESSERT)

INSTANT PUDDINGS

CONFECTIONERY PRODUCTS (BREAKFAST BARS ETC)
<table>
<thead>
<tr>
<th>TABLE 11</th>
<th>NUTRITIONAL USES OF SOYA PRODUCTS IN SOUTHERN AFRICA</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>FULL FAT SOYA</td>
</tr>
<tr>
<td>TECHNOLOGY INFANT FEEDING</td>
<td>*</td>
</tr>
<tr>
<td>DAIRY SCIENCE</td>
<td></td>
</tr>
</tbody>
</table>
| CEREALS | * | * | * | * | * | *
| BAKING | | * | | * | |
| DIETARY | | * | | * | |
| HOSPITALS | | | | * | * | *
| INSTITUTIONAL | | | | * | * | *
| MEAT SCIENCE | | * | * | * | * | *
| ANALOGS | * | * | * | * | * | *
<p>| CONFECTIONERY | | * | | * | |
| ANIMAL FEEDS | * | * | | | |
| PET FOOD | * | * | * | * | * | * |</p>
<table>
<thead>
<tr>
<th>AMINO ACID</th>
<th>DEFATTED SOYA FLOUR AND FLAKES</th>
<th>TEXTURED SOYA FLOUR</th>
<th>TEXTURED SOYA CHUNKS</th>
<th>SOYA PROTEIN CONCENTRATE</th>
<th>SOYA ISOLATE</th>
<th>FOOD AND NUTRITIONAL BOARD</th>
</tr>
</thead>
<tbody>
<tr>
<td>LYSINE **</td>
<td>6.2</td>
<td>6.2</td>
<td>7.21</td>
<td>6.3</td>
<td>5.40</td>
<td>5.1</td>
</tr>
<tr>
<td>*METHIONINE **</td>
<td>1.3</td>
<td>1.3</td>
<td>1.38</td>
<td>1.4</td>
<td>1.14</td>
<td>1.14</td>
</tr>
<tr>
<td>*CYSTINE</td>
<td>1.5</td>
<td>1.5</td>
<td>1.28</td>
<td>1.6</td>
<td>1.37</td>
<td>1.37</td>
</tr>
<tr>
<td>THREONINE **</td>
<td>4.2</td>
<td>4.2</td>
<td>4.08</td>
<td>4.2</td>
<td>3.21</td>
<td>3.5</td>
</tr>
<tr>
<td>LEUCINE **</td>
<td>7.9</td>
<td>7.9</td>
<td>8.07</td>
<td>7.8</td>
<td>6.63</td>
<td>7.0</td>
</tr>
<tr>
<td>ISEOLUCINE **</td>
<td>4.7</td>
<td>4.7</td>
<td>4.61</td>
<td>4.8</td>
<td>3.97</td>
<td>4.2</td>
</tr>
<tr>
<td>*PHENYLALANINE **</td>
<td>5.2</td>
<td>5.2</td>
<td>5.30</td>
<td>5.2</td>
<td>4.43</td>
<td>4.43</td>
</tr>
<tr>
<td>*TYROSINE</td>
<td>3.9</td>
<td>3.9</td>
<td>3.76</td>
<td>3.9</td>
<td>3.11</td>
<td>3.11</td>
</tr>
<tr>
<td>TRYPTOPHAN **</td>
<td>2.8</td>
<td>2.8</td>
<td>1.36</td>
<td>1.5</td>
<td>1.17</td>
<td>1.1</td>
</tr>
<tr>
<td>VALINE **</td>
<td>5.1</td>
<td>4.9</td>
<td>4.95</td>
<td>4.9</td>
<td>3.98</td>
<td>4.8</td>
</tr>
<tr>
<td>HISTIDINE</td>
<td>2.5</td>
<td>2.4</td>
<td>2.76</td>
<td>2.21</td>
<td>1.7</td>
<td></td>
</tr>
</tbody>
</table>

1,2,3, TIGER PROTEIN ANALYSIS
4,5, D.H. WAGGLE AND C.W. KOLAR - SOYA PROTEIN & HUMAN NUTRITION KEYSTONE CONFERENCE
6 FNB IN RECOMMENDED DAILY ALLOWANCES NATIONAL ACADEMY PRESS - 9TH EDIT.
* HUMAN FEEDING STUDIES SHOW THAT SOY PROTEIN PRODUCTS ARE CAPABLE OF MEETING THE AMINO ACID REQUIREMENTS OF ADULT SUBJECTS WITHOUT SUPPLEMENTATION WHEN GIVEN AS THE SOLE SOURCE OF DIETARY PROTEIN. HOWEVER, SUPPLEMENTATION WITH METHIONINE IMPROVED THE UTILISATION OF THESE PRODUCTS, MAKING IT POSSIBLE TO REDUCE THE TOTAL AMOUNT OF SOY NECESSARY TO MEET THE ESSENTIAL AMINO ACID REQUIREMENTS.

* IT HAS BEEN SHOWN THAT THE TEST LEVEL OF DIETARY INTAKE (gN/DAY = g PROTEIN/KG/DAY) IN EXPERIMENTAL WORK, HAS A DECIDED INFLUENCE ON THE RESULTS SHOWN BY HUMAN SUBJECTS.

* IT APPEARS IN GENERAL THAT AVAILABLE LYSINE IN SOY PRODUCTS IS LESS AFFECTED BY PROCESSING (HEAT, ETC), THAN ARE OTHER PROTEIN PRODUCTS.

* WHEN THE SOY INTAKE IS SUFFICIENT TO MEET THE DIETARY ALLOWANCE FOR TOTAL PROTEIN (F&NB 1974), THERE IS NO MEASURABLE EFFECT OF METHIONINE SUPPLEMENTATION, THEREFORE IN THE CONTEXT OF THE USAL DIETS OF ADULTS THAT INCLUDE MIXED SOURCES OF PROTEIN, THERE IS LITTLE NUTRITIONAL OR PUBLIC HEALTH JUSTIFICATION FOR REQUIRING SUPPLEMENTATION OF SOY PROTEIN PRODUCTS WITH METHIONINE.
SENSORY EVALUATION CHART
AFTER LUNCH, 21 MAY 1986:

PLEASE TICK THE BOX UNDER THE SMILEY FACE WHICH BEST DESCRIBES THE WAY YOU FEEL ABOUT THE PRODUCT. BASE YOUR JUDGEMENT UPON MEAT QUALITY CHARACTERISTICS
SUCH AS GENERAL APPEARANCE, JUICINESS, TEXTURE, FLAVOUR AND ODOR.

MERK ASSEBLIEF DIE BLOKKIE ONDER DIE "SMILEY FACE" WAT U MENING OOR DIE
PRODUKTIE DIE BESTE BESKRIF. BASEER U BESLUITING OP VLEISKwaliteitseiSKEIKAPPE
SOOS BYVoorBEELD ALCkEME Voorkoms, SAPPIGHEID, TEKSTUUR, SMAALKLIKHEID EN
AROMA.

1 SAUSAGE: [ ] [ ] [ ] [ ] [ ] [ ]
GENERAL COMMENT(S)/ALGEMEEN KOMMENTAAR: ____________________________

2 CHICKEN
A LA KING: [ ] [ ] [ ] [ ] [ ] [ ]
GENERAL COMMENT(S)/ALGEMEEN KOMMENTAAR: ____________________________

3 HAMBURGER PATTIES: [ ] [ ] [ ] [ ] [ ] [ ]
GENERAL COMMENT(S)/ALGEMEEN KOMMENTAAR: ____________________________

4 BOBOTIE: [ ] [ ] [ ] [ ] [ ] [ ]
GENERAL COMMENT(S)/ALGEMEEN KOMMENTAAR: ____________________________

5 INSTANT DESSERT: (FLAVOUR: CARAMEL/CHOCOLATE/STRAWBERRY?) (CIRCLE)
[ ] [ ] [ ] [ ] [ ] [ ]
GENERAL COMMENT(S)/ALGEMEEN KOMMENTAAR: ____________________________

THANK YOU VERY MUCH/BAIE HARTLIKE DANK
REF: [MT REG SE CHART W15]
CURRICULUM VITAE

M.A. JENKIN

Born.
Cape Town 1947

Education.
Matriculated Rondebosch Boys High School 1964.

Experience in the Food Industry.

1968
Employed as Quality Controller by Amalgamated Fisheries/Atlantic Trawling (Division of Table Top).
Duties included spec. compilation, management of dept. etc. for frozen and prepared fish products.
Some applied research relating hake species to specific trawling grounds.

1972
Appointed production manager of Amalgamated Fisheries.

Various Quality Control and Development positions within Table Top.
Associated with development of fish, meat, chicken, frozen vegetable, fruit juice and other prepared food products.

1978
Appointed Q/C Manager for Cherrywood and Model bakeries to establish basic Q/C systems and development methodology.

1979
Appointed to Central Laboratories of Asokor (to become Kanym). Product Development.

1981
Appointed Lab. Manager of Central Laboratories.

1983
Took on function of Packaging Development.

1985
Appointed R&D Manager.
OVERVIEW OF THE S A MEAT PROCESSING INDUSTRY AND BASIC MEAT PRODUCT PROCESSING METHODS

BY: M JENKIN
KANHYM LTD
The South African Meat Industry, like the meat industry from any other country, developed out of a necessity, to utilise the whole carcase.

As has already been outlined, to hold the price of desirable fresh meat cuts as low as possible, it is essential that the processor who purchases the "undesirable" meat cuts, can convert them into desirable articles profitably.

The earlier demonstrations illustrating the functional properties of meat proteins made use of relatively "good quality" lean meats - these demonstrations brought home the fact that meat proteins, with variable properties related the age, sex, breed, stress etc of the animal, were in fact not the ideal starting proteins for the production of a meat product. From this, one must realise that the meat processor has an extremely difficult job, having to use far-from-ideal meat cuts to try and achieve similar and consistent results.

One of the main problems in the meat industry always was - and still is today - the profitable use of lower grade meats, cheaper cuts and trimmings.

By means of processing, to change the characteristics of these meats (cheaper cuts, trimmings etc.), such meats can be converted into a great variety of sausages, smoked, cooked and dried meat products.
The South African market is unique and therefore the types of meat products manufactured to suit the eating habits and pockets of the entire population spectrum, must also be unique in cross section.

This may sound unimportant, and you may say "I've heard THAT a thousand times," but in reality it must be accepted. South Africa is not Germany, England, Italy nor the United States, and neither do South Africans have the same culture, needs or eating habits. Although some South Africans do have German, English, Italian or American backgrounds, these persons and their needs/eating habits are by no means representative of the entire population.

In terms of plant and equipment, the meat processing industry faces vast expenditure both in the capital items and running cost areas. The following illustrates:

1) **Premises.** Because of stringent laws and regulations necessary to safeguard the health of the consumer, the manufacturer has to pay a heavy price in providing sanitary facilities in terms of special flooring, tiling of working areas etc.

2) **Equipment.** Again for sanitary reasons, equipment necessary for meat processing is primarily manufactured of stainless steel, and because of the necessity for frequent washing and sanitising, expensive waterproofing is necessary - another major expense.

3) **Refrigeration.** Separate refrigerated areas are required for raw and cooked meats to obviate cross contamination, requiring extensive insulated areas and costly refrigeration systems. When working with chilled products, it is essential not to break the cold-chain if the shelf-life of the product is to be guaranteed. This, in many instances, requires the installations of expensive airconditioning in processing, packing and despatch areas, to hold the ambient temperatures at about 10°C, a difficult task in areas adjacent to cooking pots and large smoke houses.
4) Cooking and smoking facilities. As most processed meats are precooked or smoked, and enormous amount of energy is required in processing for cooking or subsequent cooling prior to packing and storage - another major expense.

For any manufacturer to run a viable and profitable operation, these costs must be recovered, and to remain competitive the recovery per unit sold must be as low as possible. For this to be possible, volumes through the plant must be high enough and this requires a market that can absorb the volumes required to recover overheads and processing costs.

In the South African context, this presents a dilemma, with our heterogeneous population having totally different requirements. Which market do we aim for?

1) The relatively limited up-market requiring good variation?
2) The large lower-income market requiring basic nutrition?

A large manufacturer with massive overheads has only one option - to be "all things to all men" and satisfy a wide spectrum of markets.

Over the years the South African meat industry has come under fire from all quarters for degrading and downgrading meat products. Many are the comments such as "The rich, ripe flavour associated with long-cured ham has gone," "Viennas are not as meaty as they used to be," etc.

Much of the criticism was justified, but then much was not. In the light of adverse exchange rates, the meat industry has also been badly hit, and to hold prices at reasonable levels as well as bring certain bread-and-butter products within the reach of the black consumer, it has been necessary to reformulate,
Like many industries, the meat industry is reliant on the importation of many ingredients, additives and packaging materials from Europe, Japan and the United States amongst others, and has therefore "paid-the-price" in terms of the exchange rate.

A South African meat processor is reliant on the importation of articles such as non-meat proteins, starches, spices, flavourings, meats, phosphates, sausage casings, rusk, packaging raw materials and others. It may surprise you to learn that between 40 and 50% of the actual manufacturing costs of a product (distribution costs not included) are attributable to imported materials.

The South African market has also been compared to say, the German market and many people, including many in the meat industry, expect or would like the spectrum of products available in South Africa to be similar to that available in Germany.

I hope the following table and graph will put the matter in perspective.
### Comparison of earnings in Germany and South Africa

<table>
<thead>
<tr>
<th></th>
<th>Germany</th>
<th>South Africa</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population (millions)</td>
<td>±63</td>
<td>±31 (3.5 W)</td>
</tr>
<tr>
<td>Earnings/Earning Head/month</td>
<td>DM 4100</td>
<td>R700</td>
</tr>
<tr>
<td>Potential &quot;Gourmet&quot; Market (millions)</td>
<td>±50</td>
<td>±3</td>
</tr>
<tr>
<td>% &quot;Gourmet&quot; of total market</td>
<td>±80%</td>
<td>±10%</td>
</tr>
<tr>
<td>Difference, requiring basic nutrition</td>
<td>±20%</td>
<td>±90%</td>
</tr>
<tr>
<td>Needs -</td>
<td>- NUTRITION</td>
<td>✓</td>
</tr>
<tr>
<td></td>
<td>- VARIETY</td>
<td>x</td>
</tr>
<tr>
<td></td>
<td>- TITILATE PALATE</td>
<td>x</td>
</tr>
<tr>
<td>For recovery of costs needs:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Margins</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Volumes</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Reason for consuming processed meats</td>
<td>Habit</td>
<td>Price</td>
</tr>
</tbody>
</table>

![Population vs Earnings Graph](attachment:population_vs_earnings.png)
It is thus essential that the South African market be looked at in context - it is unique and the population needs with respect to processed meats are different.

As has already been stated by a previous speaker, the meat consumption in S A is on the decline - for the simple reason that the basic raw meat price is beyond the pocket of most S A consumers who are now turning, in ever-increasing numbers, to cheaper protein sources such as chicken.

To promote red meat sales, it has now become essential to make products affordable yet still nutritious. This can only be done by the use of cheaper, nutritious non-meat proteins in meat products to give the lower income population the opportunity of consuming red meat. Should this not be possible, the industry will be forced to:

1) Either close down because limited sales at "affordable" prices cannot recover costs, or
2) Charge high prices for limited volumes of high meat content products to recover costs.

As is evident from the previous table, the South African market that can afford this type of product, is limited, so the industry would be in turmoil. Let's hope that sense will prevail!
The share of any market segment depends on how well we meet
the needs of that segment -
To different people, different aspects of a foodstuff are
important -
For example, the following characteristics
- water binding
- texture/bite
- eye appeal
- colour
- taste/odour
- nutrition
- economic
are given relative degrees of importance by the different
segments of the population.

But once a consumer has assessed his/her requirements and knows
what he/she wants, it is expected every time. Imagine someone
who has chosen Gunston cigarettes as their brand, satisfying
his/her needs in terms of strength, taste, filter length etc.,
buying Gunston the next time and finding it tastes like
Courtleigh Satin Leaf Ultra Mild and Dunhill the next time he buys.
Disaster - that consumer won't buy Gunston again.

In the same way, it is important that a meat product manufac-
turer maintain a level of consistency required by the market.

For consistent or "standardised" products we need
- consistent raw materials
- consistent ingredients and additives
- consistent machinery
- consistent processes
- consistent people

If one starts with inconsistent raw materials, i.e. unstandardised
proteins, it is extremely difficult to produce a consistent or
standard product.
The following diagram illustrates the part played by standardised non-meat proteins.

**MEAT - "IMPERFECT" PROTEIN - INCONSISTENT QUALITY**

[Diagram: MEAT + NON-MEAT PROTEINS - STANDARDISED - GUARANTEED PERFORMANCE AND PROTEIN → MORE CONSISTENT END PRODUCT]

In other words, standardised proteins provide the processor with an assurance factor.

Not only do non-meat proteins make the manufacture of consistent meat products easier, they also assist in the incorporation of "difficult" meats into meat products by virtue of their water binding and emulsification properties.

As has already been stated, the ability to utilise the whole carcase helps in keeping the price of prime meats down, and in this area, ingredients and additives play a very important role.

The following list of meat cuts and processing methods illustrate:
<table>
<thead>
<tr>
<th>RAW MATERIAL</th>
<th>PROCESS</th>
</tr>
</thead>
<tbody>
<tr>
<td>RINDS</td>
<td>&quot;EMULSIFY&quot; WITH WATER</td>
</tr>
<tr>
<td></td>
<td>50:50 - ASSIST WITH N.M.</td>
</tr>
<tr>
<td></td>
<td>PROTEIN</td>
</tr>
<tr>
<td>BEEF FAT</td>
<td>EMULSIFY WITH SOY ISOLATE/CASEINATE.</td>
</tr>
<tr>
<td>MECHANICALLY RECOVERED MEAT</td>
<td>TREAT WITH SALT, PHOSPHATES, NITRATES.</td>
</tr>
<tr>
<td>INTERNAL FATS</td>
<td>EMULSIFY WITH SOY ISOLATE/CASEINATE.</td>
</tr>
</tbody>
</table>

Before we look at some basic processing methods employed in the industry, we must first look at the origins of the industry.

The following factors could be said to have promoted the birth of the industry:

1) Need to utilise "unwanted" parts of the carcase i.e. utilise the whole carcase.
2) Need to add value to trimmings generated in deboning.
3) Need to preserve the meat.
4) Need to provide variety.

In technological terms, factor 3 above could be considered to have given birth to the industry as we know it today. The vast majority of processed meats consumed today are what we term cured meats, with the term curing traditionally being understood as meaning the addition of salt to meat for the purpose of preservation.

Nowadays the term "meat curing" is understood to mean the addition of salt, saltpetre, nitrite, sugars and other ingredients for the purpose of preserving and flavouring meat. Today, curing of meat is practiced more specifically to provide a variety of meat products rather than a means of preservation.
For this reason meat curing serves to:

1) Preserve
2) Enhance the flavour
3) Stabilise the colour and
4) Provide a variety of meats,

The actual origin of the modern curing reactions is not known but one must surmise that at some stage man used salt that was "contaminated" with saltpetre for basic preservation by dehydration, and found to his surprise that afterwards the meat had a different, though pleasant colour, texture and taste.

**The Curing Reaction.**

Very simply, the curing reaction involves the reaction of nitric oxide (derived from nitrites) with muscle myoglobin to form nitric oxide myoglobin.

\[
\text{Myoglobin } + \text{ Nitrite } \rightarrow \text{ nitric oxide myoglobin}
\]

Nitric oxide myoglobin is bright red in colour and is relatively unstable in the presence of oxygen and other oxidants. To stabilise the colour it is necessary to denature the protein either by heat or by lowering the pH below 5.

The curing reaction is in fact an extremely complex set of reactions. The following diagram however illustrates the overall reaction in simple terms.
The nitrosohemochrome is the derived pigment of myoglobin that gives cooked, cured meat its typical pinkish colour. The intensity of the colour is dependant on the initial concentration of myoglobin in the muscle tissue. A beef muscle has a higher myoglobin content than pork, cured beef products tend to exhibit a much more intense pink/reddish colour than cured pork products. When beef and pork are mixed in say a cured sausage, the colour of the final product will be dependant on the ratio of the beef to pork.

**Ingredients and Additives used in meat curing.**

1. **Nitrates and nitrites.**  
   Used directly or indirectly (nitrate) with meat to produce cured meat.

2. **Salt**  
   Not only does salt play an important flavour enhancing role it also inhibits microbial growth if present in high enough concentrations.

3. **Sugars and sweetening agents.**  
The main function of sugars or other artificial sweeteners is to reduce the harshness of salt. Certain sugars also assist in stabilising the pink colour of the nitrosohemochromes while others provide readily available energy for nitrate reducing bacteria to reduce nitrate to nitrite.
4. **Ascorbic Acid**

Ascorbic acid or its salts is useful in two areas:

i) It reacts directly with nitrite to give a positive release of nitric oxide independent of any naturally occurring reducing substances in the meat. This assists in reducing the curing time.

ii) After curing, the residual ascorbic acid acts as an antioxidant, especially important in sliced cured meats exposed to light and air.

Ascorbic acid does not deepen the colour of cured meats neither does it prevent spoilage.

5. **Phosphates, citrates etc.**

Phosphates have already been demonstrated as assisting in water retention of the meat. They, like citrates, can also play an important role in the development of a buffer system in a meat product that will counter adverse changes to meat quality.

Now that we understand the basic curing reaction, we will look at the basic steps employed in the manufacture of a meat product, illustrating the manufacture of hams (whole muscle meats), polonies (sliceable, emulsified meat products) and a liver spread (spreadable, emulsified meat products).

---

**HAMS.**

The old practice of curing hams with salt and saltpetre was in many respects a hit-and-miss practice with little control over the quality of the finalised product.

It took 80 to 120 days to cure a 7kg ham - an extremely costly procedure in terms of

i) large "in-cure" inventory and

ii) sizeable volumes of hams which spoiled:

If the salt penetrated to the bone before sourness developed, the result was generally a much-too-salty ham. But too often, bacterial action advanced faster and the ham was lost:

Then came the first mechanical technique of distributing the curing solution - a technique called SPRAY PUMPING in which
pockets of brine were injected into several areas of the ham, accelerating the distribution of brine by osmosis. This resulted in a 50% cut in curing time!

Then during World War One, pushed by military demands for greater production, German meat processors changed from slow-acting saltpetre cures to Prague salt - a mixture containing salt and sodium nitrite. A ham could now be cured in 28 days.

Eventually meat packers complained that, in shortening the curing time, the cure left the meat with a porky flavour.

In the 1930's the use of nitrite/nitrate/salt blends came to the fore, giving the processor a quick cure and the consumer the old flavour! But the problem of controlling the salt level was still evident.

The first major step towards controlling salt levels, was the advent of ARTERY PUMPING, in which pickle was pumped under pressure into the artery system of the ham, giving a uniform distribution of pickle through the arteries and capillaries into every area of the meat and even into the bone marrow.

Usually injecting between 10 and 15% of the ham's weight of pickle at about 3 bar and then DRY RUBBING the outside of the ham with dry curing powder, resulted in a cured ham in 7 - 10 days, quite an improvement on the 28 days.

Artery pumping and spray pumping with nitrite/nitrate cures are still practiced though not widely so.

In the 1960's and 1970's came the development of multiple needle pumping in conjunction with massaging and tumbling. This resulted in the curing time being reduced to 18 - 24 hours.
Multiple needle pumping speeds up the even distribution of curing pickle throughout the muscle with some modern pickle injectors having in excess of 160 needles covering an area of 40 x 20 cms.

From a production point of view, multiple needle pumping is far easier and more versatile than artery pumping in that one doesn't have to carefully locate arteries for pumping and one can inject other cuts of meat that don't have major artery access. This technique can be used for injecting brine into bone-in or bone-out cuts.

With the processing of bone-out hams comes another problem - how to get meat pieces to hold together? In the process of massaging and tumbling, mechanical energy is imparted into the meat chunks, facilitating myofibrillar protein extraction by the process of limited muscle fibre disruption. These myofibrillar proteins are salt-soluble and form a sticky soluble protein coat on the outsides of the meat chunks. The protein coat then is heat-coagulated by cooking to form a binding matrix between muscle chunks and this matrix allows the products to possess the look of "intact" muscle foods such as hams.

If the massaging or tumbling is done correctly, several advantages are realised - there is accelerated brine dispersion, improved uniformity of cured colour and texture and most importantly, the production of a uniform, high-quality product is realised.

The process, however, must be carefully monitored, as both under -and over - processing lead to quality - associated problems.

Modern pickles for multiple injection contain the following components, the latter in parentheses being optional
- water
- nitrite and nitrate
- ascorbate
- buffer system - phosphates or citrates or amino acids
- sugars
- (flavours)
- (non-meat proteins)
- (vitamins)

The following overall procedure would apply to the production of modern asectioned and formed hams (refrigerated).

Inject pickle \(\pm 10^\circ\text{C}\)

\[\downarrow\]

massage or tumble 7 - 8 \(^\circ\text{C}\)

\[\downarrow\]

either/or

pack in final packaging

\[\downarrow\]

place in form

\[\downarrow\]

cook at 80\(^\circ\text{C}\)

store

pack into form

\[\downarrow\]

cut

store

With the advent of specialised phosphate blends and special soluble and dispersible non-meat proteins, the extension of hams and other injected meat cuts has become possible — using modern technology with these specialised ingredients, it is possible to pump over 100% of pickle into the meat and still produce an acceptable product. In terms of texture and flavour it cannot be likened to a ham which has only been injected with 10% pickle — they are different products, but there is a market and demand for each type.
HAMS

TRADITIONAL
- PRESERVATION BY SALTING
- NITRATE ODOUR/FLAVOUR
- SOAKING/DRY SALTING
- SMOKING

ADVANTAGES
- STRONG FLAVOUR AND AROMA
- "SELF" PRESERVING

DISADVANTAGES
- EXPENSIVE
- LONG PRODUCTION PROCESS = MONEY TIED UP
- LIMITED MARKET
- DIFFICULT TO CONTROL SALT LEVEL
HAMS

INJECTED
- MAKES MORE ECONOMIC
- INJECT BRINE
- USE NITRITE QUICK CURE
- FLAVOUR PROPORTIONAL TO % INJECTED
  + ADDITIVES
- SMOKING

ADVANTAGES
- PRICE - AFFORDABLE
- LARGER MARKET POTENTIAL
- SPEED
- SUCCULENCE

DISADVANTAGES
- HIGH WATER CONTENT
- MUST PRESERVE
- CAPITAL EQUIPMENT
SLICEABLE AND SPREADABLE EMULSIFIED PRODUCTS.

We must assume by now that you all understand what is meant by protein denaturation, protein coagulation, gels and emulsions. I will not elaborate on these basic concepts.

In comparing a spread with a polony-type product, the following characteristics need comparison:

<table>
<thead>
<tr>
<th>POLONY</th>
<th>SPREAD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gel structure</td>
<td>✓</td>
</tr>
<tr>
<td>Emulsify fats</td>
<td>✓</td>
</tr>
<tr>
<td>Sliceable</td>
<td>✓</td>
</tr>
<tr>
<td>Spreadable</td>
<td>x</td>
</tr>
<tr>
<td>Coagulation of meats</td>
<td>✓</td>
</tr>
<tr>
<td>Coagulation of ingredients</td>
<td>✓</td>
</tr>
</tbody>
</table>

How do we achieve these totally different characteristics using similar raw material and ingredients?

In a polony-type product, we utilise the functional characteristics of the meat and non-meat proteins to form a gel structure that is sliceable.

In a spread, we must suppress the gelling characteristics of the meat and non-meat proteins to achieve spreadability. If one cooks the gel-forming meat proteins and then incorporates this and the fats in an emulsion with a non-meat protein like sodium caseinate that doesn't form a firm gel on heating, then one has a spreadable product.

To carry a concept a bit further, it becomes obvious that one can tailor the texture of a meat product to one's wants by process variation and the selection of blends of meats and non-meat proteins to achieve a specific texture. The combinations are endless!
The following flow diagrams illustrate the differences in processes for the production of polonies and spreads, in this instance, a liver spread, prepared in a bowl cutter.

**POLONY**

Lean meat + SALT + Phosphate + 1/3 of water at 0-2°C

↓

Cut to a fine lean meat emulsion

↓

Cut in spices, mixed meats, sugars, non-meat proteins

↓

Add 1/2 of balance of water

↓

Cut in fats/fat emulsions

↓

Cut in balance of water and ascorbic acid

↓

Cut in starch (+15°C)

↓

Fill into casing

↓

Cook at 80°C to 72°C at thermal centre

---

**LIVER SPREAD**

Cut liver + Sugars + ascorbate

↓

Cut hot meats

↓

Cut in caseinate

↓

Add hot broth

↓

Cut in livers (50°C)

↓

Fill into casings

↓

Cook at 80°C to 72°C at thermal centre

Although bowl cutters are still extensively used for the production of emulsified meat products, volumes and the necessity to produce consistent or "standardised" products has fuelled processors to look to other methods of production. In this area machines such as blenders, colloid mills and FD9's have come to the fore.
The following comparison looks at the pros and cons of each process:

**TRADITIONAL**

Cutter
Sequential
Use meat functionality
get best lean meat protein extraction and best emulsification
small
high
high

**MODERN**

-equipment-
-process-
-protein function-
results-

-a compromise

blender or FD9
"all-in"
use n.m. protein functionality

-large
-low
-low
I hope the foregoing has been of some assistance in understanding the position of the meat industry in South Africa.

As mentioned, the processing methods described cover but a few of those employed by industry and are given as a guide to understanding the basics of meat processing technology.

Your patience through the last hour has been appreciated and I can only hope it has served to whet your appetite to know more.
MR CORRIE NEL suddenly took ill and MR DAVID BAILIE stood in for him at very short notice.

*****

CURRICULUM VITAE: MR DAVID BAILIE

BORN: Vereeniging, 1939

EDUCATION:
1955 Matriculated, Dale College, King Williams Town
1959-61 Studied towards B Sc Pharmacy, Rhodes University, after completing a two-year apprenticeship

EXPERIENCE:
1962-71 Joined the pharmaceutical industry on the sales-marketing side, Squibb Lab.
1972-79 Worked in the advertising industry - specialized in food company development of new products and advertising
1980-86 Consultant to Tiger Oats on the development of soya as a commodity, and consumer products
Owner of "Food for Africa" company - a company developing and supplying economic, nutritious foods and enrichment processes for staples
Chairman of the South African Soya Association

*****

REF: [MT REG BAILIE CV W15]
CURRICULUM VITAE: CORRIE NEL

PRESENT OCCUPATION: Group Public Relations Manager and legal advisor to Fedfood Limited.

Corrie Nel was born on 9 November 1952 in Johannesburg, the youngest of five children.

He completed his matric at the D P Malan High School in Johannesburg, and after military service studied law at the Rand Afrikaans University. He graduated in 1976 and qualified as an attorney in 1979, after spending two years as a journalist with the Afrikaans morning paper, Beeld.

He established his own practice in 1980 and got involved in food law during the same year. He left private practice at the end of 1984 and joined Fedfood as Group Public Relations Manager and legal advisor to the Group.

He is presently also legal advisor and vice-chairman of the South African Soya Association and has been involved with this association since its inception.

He is married and has a son.
THE BASIC BEHAVIOUR OF MEAT AND NON-MEAT PROTEINS IN MEAT PRODUCT SYSTEMS

Points of general interest concerning regulatory aspects

1. Brief for discussion:

It is my dubious honour to traverse with you the one subject affecting all of us in many varied ways. I must address affected parties interested in meat products and the relevant regulations on the nature and scope of the meat product industry in our country, South Africa, with a view of providing general knowledge specifically on the regulatory aspects.

I am not to provide a platform for argument on the proposed new regulations.

I am not here as an official spokesman for Fedfood or the South African Soya Association - just as a colleague in the food industry.

I have chosen not to try and preach, philosophize or repeat textbook law to you, but instead to come to grips with the more basic knowledge and general information required to enable us as an industry, to play a more meaningful role in the legislative process.

I have attempted to limit references to sources for this talk to the Food Stuffs, Cosmetics and Disinfectants Act, no 54 of 1972 and its regulations and one other work being Administrative Law, by G M Cockram, Jutas 1976. All quotations come from either of these two sources.
2. **Scope of talk**

I intend covering the following topics in broad terms:

2.1 The purpose, sources, social responsibility and dynamics of the law and its relevance to the food industry.

2.2 An evaluation of our existing legislation in the light of the above factors, and in our specific context.

2.3 What role could be played by industry in the legislative process.

2.4 A possible direction to be taken.

If, after the talk, you feel you have heard nothing new, I would be pleased. The law is by the people for the people. It is a logical process available to all of us. It should not be confined to the hands of a chosen few as it was in early Roman times.
3. The theory

3.1 THE PURPOSE OF THE LEGISLATIVE PROCESS may be described as to define and record the rules which we have to live by. Imagine a number of people marooned on an island just as Robinson Crusoe was. In the instance of Robinson Crusoe, he was a true free man who could live absolutely by his own rules until Friday came. Friday and the parrot, I forgot his name, forced Robinson Crusoe to show some respect and consideration for them and restricted his freedom of choice and movement.

In the instance of the marooned people, this community will soon have to agree on mutual arrangements, or rules, which would ease their interaction with each other and facilitate their survival.

Very soon a leader (dictator) or leadership party will tacitly or explicitly be chosen to govern the community, make new rules for new situations that may arise and solve problems. Similarly, certain people will be given certain tasks to perform (an executive body) and they may even appoint a wise old man to meter out justice (the judiciary).

Sometimes, as in the instance of a dictator or Robinson Crusoe, these three functions are fulfilled by one person.
However, in a modern community such as ours, the three principal organs of government, the legislature, the executive and the judiciary, are well established and recognised. The legislature is chosen through a democratic process to represent all of us and in turn appoints an executive and the judiciary.

After appointing a legislator, the legislative process starts to define and record the rules we have to live by. These are later performed and enforced by the executive and judiciary.

3.2 SOURCES OF THE LAW.
We have three well known sources of the law:

* Common Law
* Case Law
* Legislation

THE COMMON LAW consists of rules that came into existence through our interaction with each other in various situations. They are unwritten rules that we have agreed to abide by during our daily contact with each other.

In a CASE LAW, rules have been laid down by our courts according to their interpretation of the law in general, in the judgement of cases before the courts.
LEGISLATION encompasses all the rules that are consciously made by our legislature in its various forms to deal with all situations and problems in our society, and which are changed and brought up to date as society advances.

This legislature is in the first instance parliament, which enacts Bills or Acts. Because of the pressure on parliamentary time and because of the greatly increased role of the government in everyday life, much legislation today merely lays down a skeleton scheme which government departments and local authorities should follow, and then leaves it up to these authorities to implement policy by means of regulations which they are entitled to issue under particular acts of parliament.

This delegated legislation means that the executive is exercising the functions of the legislature, since delegated legislation is a substitute for legislation by parliament itself.

As far more delegated legislation is produced than there are Acts of Parliament, most of the laws by which South Africans are governed, are accordingly produced not by elected members of parliament, with maximum publicity and subsequent enrolment in the statute books in two official languages, but by unknown central and local government officials, not responsible to the electorate, with minimum publicity, whose regulations may even be very difficult for affected persons to discover.*