In any discussion of natural vs. artificial casings, it is necessary to consider the properties of each type of casing independently and determine how those properties will affect the final meat product properties that are most important. Natural and artificial casings are significantly different in cost, handling properties, smoking and cooking behavior, and final product appearance. The type of casing chosen for a specific application will require a decision on which of those properties is most critical to marketing and sale of the finished product.

Natural casings are the traditional approach and have a track record of centuries of use as containers for sausage products. Natural casings are primarily collagen from animal gastrointestinal tracts that have been stripped of the contents and of the fatty outer covering. Stripped and cleaned casings are typically salted for preservation to prevent growth of bacteria. Natural casings are essentially all collagen, which provides some unique properties for processing in terms of tenderness and permeability.

Small diameter casings are typically hog and sheep casings, with sheep being the smallest. The smaller casings have a somewhat thinner wall and will be most tender. These casings are best used for items like fresh sausage where no further tenderization occurs in the subsequent processing after stuffing. Larger diameter casings are typically beef casings and will be tougher as size increases. At the same time, large diameter casings are somewhat limited in strength and may not be able to hold the full weight of a stuffed product if suspended in the smokehouse for cooking and smoking. Large diameter natural casings are sometimes supplemented with additional support in the form of string tying or stockinettes. The string or stockinettes also add to a traditional appearance that is characteristic of some products.

Moisture Sensitivity

The collagen in natural casings is very sensitive to moisture content, particularly during cooking and smoking. Wet collagen becomes very soft and weak, while dry collagen becomes very hard and impermeable. Consequently, the initial steps of smokehouse processing should provide a mild drying environment to maintain casing strength without hardening.

Smoke application can then be made while the casing is still moist and permeable to smoke. A general rule suggested by many is that the casing surface should be “tacky” or “sticky” just prior to smoke application. After smoke deposition and color development, further drying can be implemented to firm up
the casing and reduce permeability to the point that later cooking can be applied without great moisture loss from the product.

Natural casing quality can be greatly affected by initial processing and salting when the casings are harvested, and this is subject to the procedures and care employed by the harvesting plant. Casings can be provided in dry-salted form, pre-flushed in brine, or pre-tubed to facilitate transfer to stuffing horns. In all cases, it is a good idea to flush and rinse casing before use to remove any residual contaminants.

**Microbial Considerations**

Because natural casings are of animal origin, they are inherently contaminated with bacteria, including pathogens such as *Streptococci, Enterobacteriaceae*, viruses, coliforms, and *Clostridia*, and are likely to harbor *Listeria* as well from the processing environment. However, research has shown that the salting process is very effective for control of pathogens as well as spoilage bacteria. For example, several studies in the Netherlands have shown that casings stored in salt or salt brine that achieved an available water (Aw) content of 0.85 or less reduced inoculated *Staphylococcus, Escherichia coli*, and *Salmonella* to undetectable levels in 30 days. For *Listeria*, an Aw of 0.75 was needed to reduce the organism within the 30-day storage period. The only organism not completely reduced was *Clostridia*. The Aw of 0.85 was accomplished with a salt brine of 5.2M (~23% salt). Dry salting accomplished an Aw of 0.75. Storage at 20°C was found to be more effective for reducing viable bacteria and viruses than at 4°C. Storage of salted natural casings at 20°C for 30 days is already part of the Standard Operating Procedures of the international casing industry, and thus provides an effective protective measure.

One other issue with natural casings is that the fat layer on the outside of the casing can easily become rancid if not completely removed, especially when salted, and will transfer the rancid flavors to the product. A few natural casings such as sewed bungs may retain the fat layer and, in this case, potential rancidity should be checked.

One of the most unique properties of natural casings is providing a truly traditional, old-fashioned product appearance. While use of the natural casings is likely to include greater cost, more labor, and less uniformity, the appearance is likely to be a deciding factor for traditional products.

**Artificial Advantages**

On the other hand, artificial casings have undergone a tremendous amount of development in the past decade and are now available in a wide variety of shapes, sizes, and appearances, some of which very nearly duplicate the natural casings. In addition, the artificial casings can offer coloring agents, spices, smoke flavoring, and a variety of other materials as part of the casing to be deposited on the product surface after stuffing and processing. The variety offered by artificial casings has become almost unlimited.

The basic materials used for artificial casing are collagen, cellulose, or synthesized films such as nylon. The collagen casings may be regenerated collagen that comes in tubular form ready for stuffing or co-extruded with the product in what is probably one of the most innovative recent developments in sausage casing technology. The collagen casing resembles natural casing very closely, including similar processing properties relative to moisture content and drying treatments. A major advantage to these casings is uniform size, shape, and strength.

A frequent problem encountered with regenerated collagen casings is the brittleness that can develop during extended storage. Because these casings are typically packaged in dry form (no brine or salt), extended storage can result in significant dehydration and produce a hard, brittle casing that breaks easily when stuffed.
Easy Peeling

Cellulose casings include the peelable cellulose casings used for skinless frankfurters and similar products. These casings need to be stuffed to recommended diameters to facilitate easy peeling. Smokehouse humidity is again a factor for permeability and smoke deposition with these casings, though not nearly to the same extent as for natural or regenerated collagen casings.

Large diameter cellulose casings typically include a fibrous structure to increase strength and are termed fibrous casings. These casings are available with interior coatings that will adhere to the product such as for dry sausage (to shrink as the product dries) or with an easy-release coating to facilitate peeling prior to slicing of large diameter products. Fibrous casings are also available as “pre-stuck” with minute holes to allow rapid removal of air and/or water from the surface or “drilled” with holes on the end to allow air escape during stuffing.

Artificial casings are also available as fully moisture-proof casings manufactured with nylon, saran, or other manufactured films to be used for water-cooked products or chubs where no air/smoke/moisture exchange is desired.

Because of the tremendous amount of recent innovation and new product development that has occurred in the casing industry, processors will be well served to contact casing suppliers and utilize the information and product recommendations available from these sources.