INDEX

A band, 23
Acid ionic compounds, 105
Acidulation, effect on meat, 91–92
Actin, 19
Activist groups, 1
Additives, freedom from, 88
Adenosine triphosphate, 26–27
Air travel, special problems for food, 9
American Revolution, 4
Antioxidants, mentioned, 45, 89
naturally occurring, 87
phenols, 86
Appert, Nicholas, 4, 7, 59
Ascorbic acid, 81, 84, 88–89
Aseptic processing, 60
Autooxidation, 44

B vitamins, 18
Bacillus cerus, 52
Back-inoculating, 95
Bacteriocin, 97–98
Barrier-type packaging, 77
Beef, aging of, 42
conditioning, 43
proteolysis, 43
tenderization, 43
Benzoic acid, 97
Biopreservatives, 94
Birdseye, Clarence, 6
Blast freezer, 65
Borden, Gail, 4
Boric acid, 79
Botulism. See also Clostridium botulinum
definition of, 51
protection against, 51
types of organism, 51
Boxed beef, 7
Branded food, 55
Bronze Age, 3
Bullot process, 63
Butylated hydroxyanisole, 89
Butylated hydroxytoluene, 89
Caffeine, 97
Calpain, role in contraction, 23–24
Calpastatin, 44
Campylobacter jejuni, 52
Canning, See also Heating
discovery of, 4
early industry in US, 4
ham, 59
mentioned, 38, 75
of meat, 4
types of canned meat, 38
Carbon dioxide, to preserve chilled beef, 63
Carcass, composition of, 12
fabrication of, 37
organic acid rinses, 92
Carcass chilling, effects on palatability, 36
effects on yield, 36
mentioned, 62
Cardiac muscle, 20
Case hardening, 69
Catalase, 89
Cathepsins, 44
Centralized prepackaging, 76
Chelators, 88, 90
Chemical preservatives, regulation of, 79
various kinds, 79
Chemicals, migration from Chicago, decline of meat packing, 6
meat packing center, 6
slaughter center, 4

125
Chilling, See also Refrigeration accelerated, 63–64 cryogenic, 63 effect on microorganisms, 61 ice water immersion, 63 mentioned, 101 temperature ranges used, 63 Cincinnati, pork packing center, 4

Citric acid, 90

Civil War, food needs during, 6 mentioned, 8

Cleaning, detergents, 104 foam, 104 halogens, 104 high pressure, 104 sanitizers, 104 surfactants, 105 water, 104–105

Clostridium botulinum, 51, 82, 83, 91, 97–98

Clostridium perfringens, 52

Coagulation test, 57

Cold shortening, 36, 64

Cold sterilization, 74

Collagen, 19, 22, 59

Color, See also Pigment forms as indicator of quality, 28 as surface phenomenon, 28 associated with oxidation, 45 changes over time, 42 changes in curing, 80 cured, 82
effect of animal age, 42
effect of microorganisms, 75 effect of packaging, 75
effect of smoke, 86
effect of species, 42
effect of sugar, 84
effect of sulfite, 90

Maillard, 86

reversion of, 42

Connective tissue, as a barrier, 31 cells in, 21
effect of conditioning on, 44
domysium, 21 epimysium, 21 fibers of, 22 mentioned, 20, 94

perimysium, 21 proteins of, 19

Consumer, demand for healthful food, 9 food handling education, 39 impact on food preservation, 9 influence on food preservation, 7

Contamination, effect initial microbial, 37

Cook-in-bag, 38, 66, 75, 77

C-protein, 19

Creatine phosphate, 27

Cross contamination, 50

Cultivated crops, 3

Cured meat, packaging of, 77
type of spoilage, 50

Curing, direct use nitrate, 81 early history, 80 engineering advancements, 81 ingredients, 38 regulations, 81 regulatory control, 85 results of, 82 use reductants, 81

Cytochromes, 20, 28

Cytoskeleton, intermediate

filaments, 24 microfilaments, 24 microtubules, 24

Dehydration, 69. See also Drying Delaney Clause, 80
Desmin, 19, 24
DFD meat, 28
Diacetyl, 97
Distribution chains, 40
Drip, 13, 28, 63, 68
Dry aging, 42, 45
Dry curing, 81
Dry sausage, 69, 96
Dry curing, early procedures, 69
improved systems, 69
problems with meat, 69

Early hunters, 2
EDTA, 90
Elastin, 19
Employee training, 102
Encapsulation, 92
Environment, effect of packaging, 8, 76
Erythorbic acid, 81, 84, 88–89
Escherichia coli 0157:H7, 39, 52, 109
Evisceration, 36. See also Slaughter

Fat, alterations by diet, 13
associated with human disease, 13
in muscle, 13
oxidation of, 44
oxidation products from, 13
species differences, 13
Fat cells, 23
Feathers, removal of, 36
Federal Food Drug and Cosmetic Act, 79
Federal Meat Inspection Act 1906, 81
Fermentation, back inoculation, 95
dry products, 96
inhibition pathogens, 96
mentioned, 3, 91
role of sugar, 84
semi-dry products, 96
starter culture, 95
Fertile Crescent, 2
Fibroblasts, 22
Filamin, 19
Fish, meat from, 10
perishability of, 10
production by culture, 10
Flavor, role of sugar, 84
Foil generators, 104
Food, abundance of, 1
availability of, 1
effect on health, 1
for survival, 1
Food Additives Amendment 1958, 79
Foodborne illness, 7
Food policy, 9
Food preservation, development
modern technology, 8
early attempts, 3
Food safety, 9, 110
Food Safety and Inspection Service, 39
Food service, 40
Formaldehyde, 79
F-protein, 19
Freeze drying, 70
Freezer burn, 67
Freezing, changes during, 67
cured meat, 64
curves, 65
fresh meat, 64
ice crystal formation, 65
packaging for, 65
pre-freezing treatment, 64
Fresh meat, mentioned, 88, 93, 102
types of spoilage, 50
Frozen food lockers, 6
Frozen meat, beef, 63
  drip, 5
  mentioned, 61, 64, 67
  uses of, 45
Further processing, effect aging of
  meat, 45

Genetic engineering, 33, 99
Glucono-delta-lactone, 92
Glucose oxidase, 89
Glycogen, 18
GRAS, 80, 88–90
Ground meat, 93

HACCP, mentioned, 39, 105
  principles of 106–107
Hair, removal of, 36
Hammond, G.H., 5
Handling precautions, 76
Heating, canning process, 59
  changes in composition during, 58
  changes in enzyme activity, 57
  collagen shrinkage, 59
  color changes, 58
  conduction, 56
  convection, 56
  effect extrusion, 61
  evaporative cooling loss, 57
  mentioned, 102
  microwave application, 60
  palatability changes, 58
  pasteurization, 55–56
  processing schedule, 60
  protein denaturation, 58
  radiation, 56
  sterilization, 56
  verification of, 57
Hemoglobin, 21

Hide, removal of, 36
High pressure, 75, 104
High-voltage pulses, 75
Homeostasis, 93
Human health, 34
Humane Slaughter Act 1958, 39
Humectants, 70
Hurdle, 94, 106
Hydroxyproline, 19
Hygienic standards, 101

I band, 23
Industrialization, 4
Inoculated pack studies, 84, 107
Intermediate moisture, 70
Interstate highway system, 6
Intrafusal fiber, 24
Intramuscular fat, 11
I-protein, 19
Irradiation, allowed uses, 74
  consumer acceptance, 75
  control of pathogens, 74
  early uses, 73
  explanation of, 73
  inactivation microorganisms, 73
  mentioned, 51
Isoelectric point, 13, 96

Jungle (The), 6

Kensett, Thomas, 4

Label, 76
Lactic acid bacteria, 98
Lactoperoxidase, 97
Libby, McNeil and Libby, 4
Ligaments, 23
<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipid. See Fat</td>
<td>129</td>
</tr>
<tr>
<td>Lipolytic enzymes</td>
<td>44</td>
</tr>
<tr>
<td>Liquid nitrogen</td>
<td>64</td>
</tr>
<tr>
<td>Liquid smoke</td>
<td>87</td>
</tr>
<tr>
<td><em>Listeria monocytogenes</em></td>
<td>52, 97</td>
</tr>
<tr>
<td>Livestock, domestication of</td>
<td>2-3</td>
</tr>
<tr>
<td>Lysosomes</td>
<td>44</td>
</tr>
<tr>
<td>Lysozyme</td>
<td>97</td>
</tr>
<tr>
<td>Macrophages</td>
<td>22</td>
</tr>
<tr>
<td>Marbling</td>
<td>11, 23</td>
</tr>
<tr>
<td>Marquis de Mores</td>
<td>5</td>
</tr>
<tr>
<td>Meal Ready To Eat</td>
<td>8, 55</td>
</tr>
<tr>
<td>Meat, blooming of fresh</td>
<td>29</td>
</tr>
<tr>
<td>-- chemical residues in</td>
<td>12</td>
</tr>
<tr>
<td>-- color related to freshness</td>
<td>11</td>
</tr>
<tr>
<td>-- composition of</td>
<td>2, 12</td>
</tr>
<tr>
<td>-- consumer perception of</td>
<td>11</td>
</tr>
<tr>
<td>-- definition of</td>
<td>11</td>
</tr>
<tr>
<td>-- early refrigerated shipment</td>
<td>5</td>
</tr>
<tr>
<td>-- export from Australia</td>
<td>63</td>
</tr>
<tr>
<td>-- factors for purchase decision</td>
<td>11</td>
</tr>
<tr>
<td>-- freezing point</td>
<td>61</td>
</tr>
<tr>
<td>-- freezing to control inventory</td>
<td>6</td>
</tr>
<tr>
<td>-- fresh</td>
<td>12</td>
</tr>
<tr>
<td>-- from various species</td>
<td>10</td>
</tr>
<tr>
<td>-- further processing of</td>
<td>37</td>
</tr>
<tr>
<td>-- influence of genetic selection</td>
<td>33</td>
</tr>
<tr>
<td>-- influence of management practices</td>
<td>33</td>
</tr>
<tr>
<td>-- influence of production practices</td>
<td>34</td>
</tr>
<tr>
<td>-- interior versus surface</td>
<td>41</td>
</tr>
<tr>
<td>-- nutritional benefits of</td>
<td>11</td>
</tr>
<tr>
<td>-- processed</td>
<td>12</td>
</tr>
<tr>
<td>-- quality produced</td>
<td>101</td>
</tr>
<tr>
<td>-- retail display of</td>
<td>40</td>
</tr>
<tr>
<td>-- satiety factor</td>
<td>11</td>
</tr>
<tr>
<td>-- sources contamination</td>
<td>47</td>
</tr>
<tr>
<td>-- spoilage of</td>
<td>109</td>
</tr>
<tr>
<td>-- sought as food</td>
<td>111</td>
</tr>
<tr>
<td>-- texture of</td>
<td>21</td>
</tr>
<tr>
<td>-- under attack</td>
<td>111</td>
</tr>
<tr>
<td>-- wholesomeness of</td>
<td>11</td>
</tr>
<tr>
<td>Meatborne illness, infection</td>
<td>50</td>
</tr>
<tr>
<td>-- intoxication</td>
<td>50</td>
</tr>
<tr>
<td>-- role of mishandling</td>
<td>50</td>
</tr>
<tr>
<td>-- usual symptoms of</td>
<td>50</td>
</tr>
<tr>
<td>Meat composition, role in preservation</td>
<td>31</td>
</tr>
<tr>
<td>Meat inspection, changes impending</td>
<td>39</td>
</tr>
<tr>
<td>-- laws governing</td>
<td>39</td>
</tr>
<tr>
<td>Meat inspection Act 1906</td>
<td>39</td>
</tr>
<tr>
<td>Meat processing, effect on preservation properties</td>
<td>38</td>
</tr>
<tr>
<td>Meat quality, definition of</td>
<td>11</td>
</tr>
<tr>
<td>Mechanical dehiding</td>
<td>36</td>
</tr>
<tr>
<td>Microbial contamination, during animal transport</td>
<td>35</td>
</tr>
<tr>
<td>-- during slaughter</td>
<td>35</td>
</tr>
<tr>
<td>-- influence initial load</td>
<td>36</td>
</tr>
<tr>
<td>Microbial inhibition, interaction of factors</td>
<td>84</td>
</tr>
<tr>
<td>Microbial spoilage, determining factors</td>
<td>46</td>
</tr>
<tr>
<td>-- monetary loss</td>
<td>46</td>
</tr>
<tr>
<td>-- proteolysis</td>
<td>46</td>
</tr>
<tr>
<td>Micrococcus</td>
<td>95</td>
</tr>
<tr>
<td>Microenvironment</td>
<td>94</td>
</tr>
<tr>
<td>Microorganisms, attachment of</td>
<td>46</td>
</tr>
<tr>
<td>-- competition</td>
<td>41</td>
</tr>
<tr>
<td>-- competition among</td>
<td>93-94</td>
</tr>
<tr>
<td>-- dynamics of population</td>
<td>93</td>
</tr>
<tr>
<td>-- fission</td>
<td>47</td>
</tr>
<tr>
<td>-- generation time</td>
<td>48</td>
</tr>
<tr>
<td>-- growth curve</td>
<td>47-48</td>
</tr>
<tr>
<td>-- in meat</td>
<td>93</td>
</tr>
<tr>
<td>-- inhibition of</td>
<td>49, 96</td>
</tr>
<tr>
<td>-- introduced by sticking</td>
<td>36</td>
</tr>
<tr>
<td>-- lag phase</td>
<td>48</td>
</tr>
</tbody>
</table>
mesophiles, 47  
modeling of growth, 107  
nests of, 95  
psychrophiles, 47  
thermophiles, 47  
Microwave, description of, 71  
early use, 71  
technological application, 72  
trichinae survival, 73  
Military, importance of food to, 7  
influence of food preservation, 7  
Mitochondria, 20, 23  
Modeling, 107  
Modified atmosphere packaging, 77  
Molds, hyphae, 49  
Motor unit, 24  
M-protein, 19  
Muscle, as food, 11  
as meat, 11  
as tissue, 20  
banding pattern, 20  
cardiac, 20  
circulatory system, 21, 24  
contraction of, 24  
fasciculi, 21  
fiber characteristics, 23  
fusiform shape, 21  
glycolysis, 27  
growth of, 26  
myofibrils in, 23, 24  
nervous system, 21, 24  
pennate shape, 21  
postmortem changes in, 26-28  
role structure in preservation, 31  
satellite cells, 26  
smooth, 20  
striated, 20  
 thick filaments in, 23  
thin filaments in, 23  
Muscle fiber types, definition of, 25  
mentioned, 26  
species differences, 25  
Myoblast, 26  
Myofibrillar fragmentation, 43  
Myofibrillar protein, 19  
Myoglobin, species differences, 11.  
See also Pigment forms  
Myosin, 19  
Myotube, 26  
Napoleon, 7  
NASA, food for space, 106  
Natural foods, 79  
Natural ice, use of, 5-6  
Natural vapor smoke, 87. See also Smoke  
Navy, food during voyages, 8  
Nebulin, 24  
Neolithic phase, 2  
Newly emerging pathogens, 51  
Nisin, 98  
Nitrate, in curing, 80  
reduction to nitrite, 83  
Nitrite, See also Curing  
antimicrobial activity, 83  
blocking sulfhydryls, 84  
chemistry of, 83  
effect of ascorbate, 89  
fate in meat, 83  
in curing, 80  
Nitrosamines, 81, 83, 85, 89  
Nutritional information, 76  
Organic acid rinses, mentioned, 92  
to control microorganisms, 37  
Oxidation, relationship to  
 microorganisms, 87  
Oxidation-reduction potential, 47  
Oxygen, removal by enzymes, 88-89
scavengers, 88
Oxygen transmission, 47

Package, as distribution means, 75
Packaging, 102
Packing pork, 4, 8
Pasteurization, 102. See also Canning
Pathogens, virulence of, 95
_Pediococcus_, 95
Pemmican, 69
Persian Gulf Conflict, 8
pH, effect on spoilage, 32
effect on water-binding, 13
Phagocytic cells, 97
Phospholipid, 13
Pickle, 82
Pickled pigs feet, 91
Pigment forms, deoxymyoglobin, 28–29
dinitrosylhemochrome, 29, 80
hemoglobin, 28
metmyoglobin, 29, 42, 45, 80, 89
myoglobin, 28, 80
nitrosylmyoglobin, 77, 80
oxymyoglobin, 28–29
Polycyclic hydrocarbons, 86–87.
See also Smoke
Polyphosphates, 90
Polyvinyl chloride, 76
Population, shift to cities, 4
Potassium bisulfite, 90
Poultry, meat from, 10
modern production of, 10
Poultry Products Inspection Act 1957, 39
Preservation, as integrated system, 111
by antioxidants, 87
by combining methods, 79
by smoking, 85
chemical, 110
cost of, 55
early techniques of, 7
economics of, 109
factors affecting, 33
integration of factors, 101
methods of achieving, 55
microbiological, 110
monetary impact, 2
physical, 110
role of consumer, 109
role of military, 109
role of transportation, 109
total program, 101
Processed meat, fat in, 13
mentioned, 88, 102
recontamination of, 47
Processed poultry products, 10
Prokaryotic cells, 49
Propyl gallate, 89
Protein, 12
PSE pork, 12, 28, 34
Pynchon, William, 4
Quality assurance, 103
Quality control, 102–103
Quaternary ammonium compounds, 105
Radappertization, 73–74. See also Irradiation
Radurization, 73–74. See also Irradiation
Railroad, transportation of meat by, 9
Rancidity, 44
Recontamination, 102
Refrigerated rail cars, 109
Refrigeration, See also Chilling
development of mechanical, 6.
first shipments by, 5
Residual nitrite, 85
Residues, 34
Retail package, 40
Retail-ready package, 43
Retort, 60. See also Canning
Reuterin, 98
Rigor mortis, process of, 27
resolution of, 28
species differences, 28
Rosemary, 87
Safety, over total system, 106
Salami, 96
Salmonella, 92
organism, 51
Salmonellae, 74
Salmonellosis, 51
Salt, for packing pork, 4
functions in meat, 82
in curing, 80
inhibition of microorganisms, 82
purity, 82
reduced level, 81-82
required by humans, 82
Salted pork, 4
Salting, as a preservative, 79
Sanitation, 103-104
Sarcocystis, 53
Sarcomere length, 23
Sarcoplasm, 23
Sarcoplasmic proteins, 19
Sarcoplasmic reticulum, 23-24
Sausages, types of, 38
Scalding, 36. See also Slaughter
Science, role in preservation, 108
Semiperishable product, 56
Shelf-life, fresh meat, 40
frozen meat, 62
mentioned, 77
processed meat, 40
Shelf-stable meat, 56
Sinclair, Upton, 6
Slaughter, description of process,
seasonality of, 3
separated from processing, 7
specialization of, 101
steps in, 34
transport to, 35
Smoke, composition of, 86
effect on meat, 86
liquid type, 86
phases of, 86
Smoke generator, 86
Smoke house, 56, 86
Smoking, 38
Smooth muscle, 20
Sodium benzoate, 79
Sodium lactate, 91
Sodium tripolyphosphate, 86
Sorbic acid, allowed use, 90
effect on human health, 91
Sous vide technology, 60
Space program, special problems
related to food, 9
Special interest groups, 111
Spoilage, mentioned, 7
putrid smell, 46
slime, 46
sour smell, 46
Spores, 49, 59
Staphylococcus aureus, 52, 95
Starter culture, 95, 99
Stone age, 2-3
Stress, effect on meat quality, 35
mentioned, 26, 101
Sulfites, types of, 90
Sulze, 91
Surface, browning of, 58
effect of smoking on, 85
  greening of, 46
Swift, G.F., 5
Synergy, for antioxidants, 88

T tubule, 23
Technology, adoption of, 5
Temperature abuse, 47, 83
Tendons, 23
Tertiary butylatedhydroquinone, 89
Thawing, 67
Time-temperature indicators, 58
Time-temperature relation, 57, 102
Tin can, 60
Titin, 19, 24
Tocopherols, 89
Total quality management, 105
Toxin, 107
Toxoplasma, 53
Transportation, influence on food preservation, 7
Trichinella spiralis, 53, 57, 74
Trisodium phosphate, 92
Tropomyosin and troponin complex, 19
Turkey, modern production of, 34
  necrotic fibers in muscle, 34

Ultrasound, 75
Underwood, William, 4
Union Stock Yards, 6
U.S. Army Food and Container Institute, 8
U.S. Army Natick RD&E Center, 8
USDA quality grades, 11

Vacuum aging, 45
Vacuum packaging, 76, 81, 88
Vibrio vulnificus, 53
Vinegar, 79
Viruses, 53
Vitamin, See also B vitamins
  A, 18
  C, 13, 18
  D, 18
  E, 13, 18, 34, 89, 90
  K, 18

Water, 12
Water activity, 46
Waterbath, 56
Water-binding, 12–13
Wholesome Meat Act 1967, 39
Wholesome Poultry Products Act 1968, 39
Wilson’s TenderCuts, 88
Wisconsin process for bacon, 95

Yeast, budding, 49
Yersinia enterocolitica, 53