

Index

- o*-AAP, *see o*-aminoacetophenone
 AAS, *see* atomic absorption spectroscopy
 abbey beers 196–7
absinthe 442, 571, 1097
 absorption spectroscopy 765
 ABTS, *see*
 2,2'-azinobis-(3-ethylbenzothiazoline-6-sulfonic acid)
 accidents 1007, 1008–9
 acetaldehyde 88, 899, 995–6
 acetaldehyde dehydrogenase 996
 acetic acid 88
 acetic acid bacteria 70, 115–17
Acetobacter spp. 115–17
 acetoin 88–9, 108, 685
 2-acetyl-1-pyrroline (ACPY) 119
 2-acetyltetrahydropyridine (ACTPY) 119
 2-acetylthiazole 779
 acidity
 adjustments in red wine 312
 adjustments in white wine 290–2
 role in beer production 145–6
 role in wine maturation and ageing 359–60
 see also pH measurements
 acids, analysis of 727, 801–3, 884–5
ACPY, *see* 2-acetyl-1-pyrroline
 acrolein 578
ACTPY, *see* 2-acetyltetrahydropyridine
 additives 1065–73
 ADH, *see* alcohol dehydrogenase
 adolescents 1017
AdSCP, *see* adsorptive stripping chronopotentiometry
 adsorptive stripping chronopotentiometry (AdSCP) 862–3
 adsorptive stripping voltammetry (AdSV) 865
AdSV, *see* adsorptive stripping voltammetry
 adulteration 638–9
 ‘adulteration triangle’ 783
 Advocaat 625
AEDA, *see* aroma extract dilution analysis
 aerobic cell metabolism 1039
 AES, *see* atomic emission spectroscopy
 aflatoxins 1101–2
 Africa, fermented drinks of 222–5, 228–9
 After Shock 623
Agave spirits, *see* mezcal; tequila
Agave spp. (maguey plants) 226, 567
 ageing
 accelerated 168, 370–1, 393
 atypical 369–70
 distinguished from maturation 354–5
 effects of 366–70
 factors affecting 355–66
 oxidative 393
 see also maturation
AJC, *see* apple juice concentrate
 akvavit 541–3
 albumen 348, 1070
 alcohol
 absorption of 993
 addiction to 1009
 and body weight 999
 and DNA damage 1001, 1021
 and nutrient deficiencies 1000–1, 1012, 1015–16
 blood levels 994
 catabolism 994–1000
 effects on intake of foods and energy 997–8
 energy value 936, 1031–2
 factors influencing consumption 1003–5
 harmful effects of 938–40, 1007–1020
 health benefits 938, 943, 1006, 1020–2, 1050–3
 ingestion of 994
 intake 937–8, 962–3
 interactions with drugs 1010–11
 levels of consumption 1005–7
 nutritional value 966–7
 origin of word 17–18
 poisoning 1018
 restrictions on 28–9, 1004–5
 standardization of content 937

- alcohol (*Continued*)
 the term 936
 terminology in winemaking 86
 units of 937, 1006
 variability in content 966
 withdrawal syndrome 1020
see also alcohols
- alcohol dehydrogenase (ADH) 994–7
- alcohol free beverages, *see* nonalcoholic beverages
- alcoholic beverages
 from 1100 to 1750 18–23
 from 1750 to 1900 24–8
 from 1900 to present day 28–35
 from beginnings to 1100 AD 12–18
 health perception of 53–4
 industry 11
 organic 33, 56
see also alcohol; low alcohol beverages; nonalcoholic beverages
- alcoholic dementia 1017
- alcoholic fermentation 72–93
 aroma compounds 88–93
 by-products 85, 88–93
 characteristics of yeasts 72–3
 effects of oxygen 90–1
 effects of temperature 92
 growth of yeast population 77–80
 monitoring 85
 nutritional requirements of yeast 73–5
 overview of 80–6
 problem indicators 85
 use of selected yeast strains 76–7
 use of ‘wild’ yeasts 75–6
 vessel design 77
 yeast flocculation 87
- alcoholic ‘proof’ 937, 956
- alcoholism, *see* alcohol, addiction to
- alcohols 936–7
 definition 936
 higher (fusel oils) 86, 89, 276, 599–600, 936
 in grapes 276
see also alcohol
- alcopops 52–3, 958
- aldehydes 110
- ALDH2 1015
- ale houses 18
- alembic stills 17, 458, 465
- ales
 brown 198–9
 cask-conditioned 45–6, 164, 178
 cream 199
- mild 201
 old 202
 pale 202–3
 Scotch 205
 stock 202
 strong 202
 the term 19
see also ale houses; ale stakes
- ale stakes 19
- alginates 332, 348
- Al-Kindi (Alkindus) 459
- allergenic substances 1098–104
- allergy 1013
- almond liqueurs 622, 624
- Altbier 197
- Alzheimer’s disease 1021, 1060
- Amaretto 624
- amazake 216
- amertume 111
- o*-aminoacetophenone (*o*-AAP) 369–70
- amino acids
 in wort 160
 methods for analysis 733–4, 804–5
 nutritional value 971
- ammonia, determination of 804, 858–9, 900
- amyloytic enzymes 806–7
- analysis of variance (ANOVA) 825
- analytical methods 631–2
 chemical 896–907
 chromatographic 705–54
 development of 35–40, 642–5
 electrochemical 855–73
 in determination/identification of components 639–42
 in fraud detection 636–9
 in investigation of physicochemical processes 641–2
 in process monitoring 633–6
 physical 896–907
 spectroscopic 765–843
see also electrophoretic techniques; flow injection techniques; sample preparation; sensory analysis
- anethole 441, 570–1, 1095
- ‘angels’ share’ 493
- Anheuser-Busch InBev 43
- aniseed (*Pimpinella anisum*) 441, 570, 571
- aniseed flavored spirits 570–2, 820
- aniseed liqueurs 623
- Anisette 623
- ANN, *see* artificial neural network
- anodic stripping voltammetry (ASV) 865

ANOVA, *see* analysis of variance

anthocyanidins 307–8

anthocyanins

and color of red wine 307

condensation products of 774–7

estimation of content 800–1

in apples and pears 236–7

in fruit wines 428–9, 430

in fruits for winemaking 420–2, 429

methods for analysis 707, 749, 753–4, 791, 797,

833–7, 887

role in wine maturation and ageing 361

see also total anthocyanin index; phenolic compounds

'antinutrients' 987

antioxidant ability assays 810–14, 873

antioxidants

definition of 1043

in food 976, 1043–4

mechanisms of protection 976, 1043–4

removal of reactive oxygen species 1041–2

see also phenolic compounds; phytochemicals

APCI, *see* atmospheric pressure chemical ionization

'aperitif effect' 998

API, *see* atmospheric pressure ionization

APPI, *see* atmospheric pressure photochemical ionization

applejack 23

apple juice concentrate (AJC) 251, 252, 254

detection in cider 735

in cider spirits production 605–6

apple spirits 245, 603–7

apple wines 232

aqua ardens 17, 22, 457

Aquavit 22

aqua vitae 17, 22, 574

arabinoxylans 1036–7

arak 23

distinguished from arrack 555

Middle Eastern 570

origin of word 17

arginine 104

Armagnac 589

Armagnac stills 465

aroma compounds

analytical methods 647–91, 777–9

in Bourbon whiskey 523–4

in cider 242–3

in fruits for winemaking 424

in honey 432–3

in hops 150–2

in Port 405–6

in wine 88–93

in wine grapes 275–6

see also odor

aroma extract dilution analysis (AEDA) 523, 688, 923–5

aromatized wines 436, 444–5

see also Vermouth

arrack 531, 566

distinguished from arak 555

arsenic 35

determination of 819, 891

Artemisia spp. 439–40, 1096

artificial neural network (ANN) 645

artificial noses, *see* electronic noses

artificial sweeteners 1070

β -asarone 442, 1095–6

ascorbic acid 129–30, 980–1

determination of 871–2, 895

Asian grain spirits 543–53

Aspergillus spp. 1102

aspiration method 902–3

Asti Spumante 341

stringency 309, 777, 837, 882, 921–2

ASV, *see* anodic stripping voltammetry

ATA, *see* atypical ageing

atherosclerosis 835, 981, 989, 1009, 1052–3, 1057–8, 1060

see also cardiovascular disease

atmospheric pressure chemical ionization (APCI) 39, 748, 828

atmospheric pressure ionization (API) 747

atmospheric pressure photochemical ionization (APPI) 748

atomic absorption spectroscopy (AAS) 36, 815–23

atomic emission spectroscopy (AES) 816, 823–5

atomic spectroscopy techniques 814–25

ATR, *see* attenuated total reflectance

attenuated total reflectance (ATR) 786, 792

attenuation 158, 159

atypical ageing (ATA) 369–70

autoimmune responses 1013

awamori 23, 549

2,2'-azinobis-(3-ethylbenzothiazoline-6-sulfonic acid)

(ABTS) 811, 873

azorubin 730

Babycham 33, 256, 257

Bacterium Club 25

bagaceiras 598

bag in the box (BIB) 376–7

Bailey's Irish Cream 625

°Balling scale 272, 273

Barbera 303

- Bärenfang 622
 barley
 breeding new varieties 475–6
 for beer production 134–7
 for Scotch whisky production 475–7
 genetically modified 58
 germination process 136–7
 grain contents 134–5
 see also malting
 barley wines 197
 ‘barm ale’ 163
 Barrell process 448
 barrier crown technology 193
 base malts 140
 batch column stills 462–3, 464, 466
 Beaujolais 33
 beer 132–207
 addition of hops to 18, 19
 basic brewing process 132–4
 bittering agents 727–8, 809
 blanket pressure 190
 boiling the wort 148–56
 bottle-conditioned 46–7, 170, 182, 195
 bottom fermentation process 167–9
 brewery-conditioned 164, 183–4
 canned 30
 cask-conditioned 45–6, 164, 178, 182–3, 186–9
 changes in drinking habits 47–8
 closures 30, 193
 color measurements 35–6, 794–5
 continuous fermentation process 171–3
 cream flow 30
 decline in consumption 29
 dietary fiber content 1036
 dispensing of draught 186–92
 early 15, 18
 fermentation process 157–65
 fining agents 154–5, 178–9
 flavored 199–200
 foaming properties 163, 173, 175–8, 880, 906
 gluten free 1100
 hazes 173–5, 176, 178, 906
 health perception 53–4
 high carbohydrate 1034–5
 high gravity brewing process 171
 history of 13–19, 24–6, 30–1
 lambic 169–70, 200
 light/low calorie 30
 low alcohol 30, 447–52, 964
 low carbohydrate 54, 1033–4
 malting process 134–43
 mashing process 143–8
 nonalcoholic 30
 nutrient content 952–5
 organic 31, 56
 oxidation reactions causing stalng 192–6
 packaging 30, 47–8, 182–6
 phytochemicals in 990
 predicting flavor stability 783–4
 production areas 4–5
 quality control 19
 red 204
 revival of traditional styles 45–7
 role of water 145–6, 953
 ‘small’ 964
 spoilage organisms in 114, 117–19
 steam 170, 205
 styles of 196–207
 the term 19, 132
 top fermentation process 163–7
 top pressure 190, 192
 wheat 206–7
 see also beer treatment
 beer engines 188–9
 beer foam assessors 906
 beer treatment 173–81
 filtration 179–81
 fining 176–9
 pasteurization 181
 beksaeju 222
 Bénédicte 23, 616, 621
 bentonite 349, 1069, 1070, 1083
 in Champagne production 329, 330, 332
 in cider production 248
 in wine production 275, 289, 346
 benzene 1088
 benzoate additives 739, 1068
 benzoic acid 727, 1068
 beopju 213–14
 BIB, *see* bag in the box
 Bièvre de Garde 197
 Bikerman’s method 906
 binge drinking 54–5, 1005–6, 1017
 Biodiversity in Wine Initiative (BWI) 371
 biodynamics 56–7, 371–2, 373
 bioethanol 459, 467–8
 from palm wine 229
 biogenic amines 1098–100
 in cider 245
 determination of 707, 731–3, 805, 888
 nutritional value 971–2
 biosensors 872–3

- biotechnology 375
 biotin (vitamin B7) 980
 bitter 197–8
 bitter aperitifs 444
 bittering agents,
 in beer 727–8, 809
 in hops 150–2, 808–9, 1097
 in Vermouth 442–3
 bitterness 309, 921
 determining 153, 809
 blackthorn (*Prunus spinosa*) 618
 blanket pressure beer 190
 blood, as fining agent 348
 'Bloody Mary' 950
 'bloom' 271
 BMI, *see* body mass index
 Bock beers 198
 body fat 965
 body mass index (BMI) 965, 1030
 Boe, Fransiscus de la 536
 bokbunjaju 618
 bone fractures 1018
 Bordeaux mixture 26, 36, 56
 Bordeaux wines 27
Botrytis cinerea 70
 botanicals 436
 antioxidant properties of 814
 in gin 538–9
 in liqueurs 620–4
 in Vermouth 439–43
 bottle ageing 355
 see also ageing
 bottle-conditioned beers 46–7, 170, 182, 195
 bottle-conditioned cider/perry 247
 bottle fermentation 249, 331–3
 bottles
 beer 185
 PET 193, 376–7, 1090
 Scotch whisky 497
 wine 20–1, 376–7
 see also bottling
 bottle shock (bottle sickness) 358
 bottling
 beer 185
 Scotch whisky 497–8, 511–12
 wine 298–300
 bottom fermentation 167–9
 Bourbon whiskey 28, 520–7
 aroma compounds 523–4
 regulations 522
 use of charred casks 525–6
 brandy 574–5
 American 590
 Armagnac 589
 base wine 575–8
 blending 585–6
 Cognac 586–8
 distillation 578–83
 fermentation 576–7
 fruit, *see* fruit spirits
 history 574–5
 maturation 583–5
 nutrient content 956
 origin of word 22, 574
 pisco 591–2
 production in Balkan countries 590
 quality control 592–3
 regulations 575, 583
 sensory evaluation 592–3
 South African 590–1
 South American 591–2
 Spanish 589–90
 terminology 584
 yeasts strains 576
 brandy-based liqueurs 23
 brett 118, 119
Brettanomyces spp. 118–19
 breweries, decline in number 29–30
 Brewers Association (SIBA) 45, 46
 brewery-conditioned beer 164, 183–4
 brewpubs 46
 °Brix scale 158, 272, 273, 279
 brown ales 198–9
 'bubble train' 326, 368
 buckwheat 142
 Burgundy wines 27
 Burtonization 899, 953
 Burton Union system 165
 Bushmills distillery 516, 518
 2,3-butanediol 88–9
 2,3-butanedione, *see* diacetyl
 γ-butyrolactone (GBL) 443–4
 BWI, *see* Biodiversity in Wine Initiative
 Cabernet Franc 302
 Cabernet Sauvignon 300–1
 cachaça 556–64
 ageing 563, 565
 distillation 561–3
 fermentation 560–1
 flavor characteristics 564
 cadmium, determination of 818–20, 891

- caffeic acid 130
 calcium 984–5
 determination of 808, 899
 in beer 953, 984
 Californian common beer, *see* steam beers
 calorie, definition of 1030
 calorific values 1031–2
 Calvados 260, 603–4
 Campaign for Real Ale (CAMRA) 31, 44–5
 Campari 444
 Campbeltown region 502–3, 504
 Campden tablets 127
 CAMRA, *see* Campaign for Real Ale
 cancers 104–15, 1039, 1051, 1053, 1095
Candida spp. 120
 canning 185–6
 canonical correlation analysis (CCA) 792
 canonical discriminant analysis (CDA) 773
 canteiro 398
 capillary electrochromatography (CEC) 38, 888,
 889
 capillary zone electrophoresis (CZE) 38, 882–8
 cap management 314, 318
 caramel 1069
 caraway 542, 623, 814
 carbamyl phosphate 104
 carbohydrates
 analytical methods 791–2
 metabolizable 1030–3
 nonmetabolizable 1035–7; *see also* dietary fiber
 nutritional value 967–70
 see also high carbohydrate beers; low carbohydrate
 beers
 carbon (charcoal) 349, 521, 526
 carbonated wines 339–4
 carbonation 339–40
 carbon footprint, in wine production 373–4
 carbonic maceration 33, 312–13
 cardiovascular disease 1009–10, 1020, 1038, 1051, 1053,
 1060
 Carlsberg laboratory 25
 carotenoids 405, 750, 838, 1094–5
 Carpano, Antonio 437
 carrageenan 154, 1069
 casein 348
 cask-conditioned beers 182–3
 dispensing of 186–9
 revival of 45–6
 cask-conditioned cider/perry 247
 casks 20, 182–3
 for American whiskeys 525–6
 for cider 247–8
 for Scotch whisky 491–4
 cask washing systems 183
 cassava 225
 catalases 996, 1042–3
 catechins 774–6, 780–9
 cathodic stripping voltammetry (CSV) 865
 cauim 17, 225–6
 CCA, *see* canonical correlation analysis
 CCC, *see* counter current chromatography
 CDA, *see* canonical discriminant analysis
 CDtrodes 861
 CEC, *see* capillary electrochromatography
 celiac disease 942, 971, 1100
 cellulose filtration 353
 Celts, the 16
 centrifugal precipitation chromatography (CPC) 754
 centrifugation 181, 344–5
 CGM, *see* concentrated grape must
 Champagne 21, 324–39
 additions 328–9, 330
 assemblage 330–1
 bottle fermentation 333
 cru classification 27
 disgorging 335–8
 faults 338–9
 grape varieties 326–7
 harvesting procedures 327–8
 nonvintage 330
 on lees (sur lie) bottle maturation 333–4
 preparation for bottle fermentation 331
 pressing grapes 328
 riddling 334–5
 riddling aids 332
 the term 324
 tirage 331–3
 vintage 330
 yeasts for first fermentation 329–30
 yeasts for second fermentation 331–2
 Champagne region 27
 chapeau brun 253
 Chaptal, Jean-Antoine 26
 chaptalization 26, 290
 charcoal filtration 521, 526
 Chardonnay 267–8, 275
 Charente pot 587
 Charente region 586
 Charmat process 340–1
 Chartreuse 23, 616, 621–2
 checked fermentation methods 448–9
 chemical ionization (CI) 39

- chemical methods 896–907
 Chenin Blanc 269, 275
 cheongju 213, 214
cherry brandy, see cherry liqueurs
 cherry liqueurs 616, 618
 chica 225
 Chinese liquors 544–7
 chiral HPLC 741–2
 chiral ligand exchange chromatography (CLEC) 742–3
 chiral MDGC 718
 chiral stationary phases (CSPs) 741–2
 chloride 899, 983
 chlorinated hydrocarbons 1088
 chlorophyll derived compounds 405, 750–1, 838, 1093–4
 chocolate beers 199
 choline 980
 choujiu 212
 chromatographic methods 705–54
 counter current 752–4
 gas chromatography (GC) 709–22
 liquid chromatography (LC) 722–52
 thin layer chromatography (TLC) 706–8
 chromatography 37–8
 see also chromatographic methods
 chungju 216
 chuseongju 623
 Chylls Yoghurt Liqueur 625
 CI, *see* chemical ionization
 cider 231–63
 aroma compounds 242–3
 bottle-conditioned 247
 cask-conditioned 247
 crushing process 238–40
 distinguished from apple wines 232
 fermentation processes 241–5, 255–6
 fining agents 248–9
 flavored 255
 foaming properties 250, 881, 906
 history of 22, 231
 in France 247, 249, 253, 259–60
 in Ireland 253, 258
 in Spain 249–51, 260–1
 in UK 52, 247, 248, 249, 251–2, 257–9
 in USA 52
 large-scale production 251–4
 nutrient content 955
 prefermentation treatments 241, 249, 256–7
 pressing process 240–1
 production areas 3–5, 257–63
 revival 33, 52
 traditional/small-scale production 239, 245–51
 yeast strains 241, 247, 251
 see also cider apples; hard cider
 cider apples 232, 233–8
 classification of 233
 harvesting 238–9
 phenolic compounds in 233, 234–7
 cider brandy 604–7
 CIE L*a*b color space 796
 cinchona bark 442
 cinnamon flavored liqueurs 623
 cirrhosis 957, 965, 966, 1012–13
 citric acid, determination of 803
 citric acid cycle, *see* tricarboxylic acid cycle (TCA)
 citrulline 104
 CIVC, *see* Comité Interprofessionnel du vin de Champagne
 claret 27
 clarification 21, 289, 343–54
 see also fining; fining agents
 Clarke oxygen electrode 868
 CLEC, *see* chiral ligand exchange chromatography
 Clinitest 296
 Cliquot, Madame 21
 closures
 beer 30, 193
 wine 20–1, 299–300, 365–6, 810
 see also cork stoppers
 cochineal 1069
 cocktails 958–9
 coco liqueurs 624
 coconut palm sap 566
 coffee liqueurs 624
 Coffey, Aeneas 28, 466
 Coffey stills 28, 458, 466
 Cognac 28, 586–8
 classification system 28, 588
 rancid character 583, 588
 Cognac stills 465–6
 columulone 150–1
 cold contact method 448
 cold trub 155–6
 Lombard 269, 275
 colorants 1069
 colorimeters 35–6, 794
 colorimetric reactions 794, 798
 colorimetry 794
 color measurements
 beer 35–6, 794–5
 wine 795–7
 combustion methods 907

- Comité Interprofessionnel du vin de Champagne (CIVC) 324, 327
concentrated grape must (CGM) 290
concentrates 625
see also apple juice concentrate (AJC); concentrated grape must (CGM)
conductance measurements 37, 855
Congo Red method 807
Constellation Brands 43
containers
aluminium 30
earthenware 549, 602
for beer 30, 182–6
for wine 20, 300, 364, 376–7
plastic 377, 1090
porcelain 546
wooden 20
see also casks; bottles; kegs
continuous fermentation method 30, 171–3
cascade type 171–2
in low alcohol beer production 452
in sparkling wine production 342–3
using bioreactors 172–3
continuous wave NMR (CW NMR) 767
Cooley Distillery 516, 518–19
coolships 154, 155
copper
as trace element 985, 1070
determination of 808, 861, 862, 866, 867
use for pot stills 487, 580
copper (brewing vessel) 149
copper citrate 1070
copper sulfate 298, 1070
corkscrews 21
cork stoppers 20–1
aromatic profile of 687–8
role in cork taint problem 299–300
role in wine ageing 365–6
cork taint 1090
analytical studies 667, 672
in Champagne 339
role of molds 70, 120
role of type of closure 299–300
corn whiskey 528
correlation spectroscopy (COSY) 769, 770–1, 772, 773, 774, 777, 778
COSY, *see* correlation spectroscopy
coumaric acid 130
coumarin 730, 1095
counter current chromatography (CCC) 752–4
counter current extraction 689
country wines 419, 423, 429–31
CPC, *see* centrifugal precipitation chromatography
Crabtree effect 84
craft breweries 44–5, 46
cream ales 199
cream flow beers 30
cream liqueurs 624–5
crémants 325
crème de cassis 617
Crème de Menthe 622–3
Crème Likier Mleczny 625
crown corks 30, 193
cru classification 27
CSPs, *see* chiral stationary phases
CSV, *see* cathodic stripping voltammetry
Curaçao liqueurs 619, 620
cuvée 325, 328
CW NMR, *see* continuous wave NMR
cyanocobalamin (vitamin B12) 980, 1001
cyclic voltammetry 864–5
cytochromes 1040–1
CZE, *see* capillary zone electrophoresis
Daeipsul 623
daepo 214
Dalton's Law 190–1
β-damascenone 727
Dampfbier 170
dansul 213
DAOs, *see* diamine oxidases
DAP, *see* diammonium phosphate
DDG, *see* distillers dried grains
dealcoholization 375–6, 450–3
défécation, *see* keeving
dégorgement, *see* disgorging
dehydration 966
Dekkera 118, 119
dementia 1021
see also alcoholic dementia; Alzheimer's disease
densitometers, *see* density detectors
density detectors 904–5
density measurements 903–6
deoxynivalenol (DON) 1103
dephlegmator 463
DEPT, *see* distortionless enhancement by polarization transfer
derivative potentiometric analysis (dPSA) 862
detection frequency analysis (DFA) 924
deuterium 781–2
dextrins 968
DFA, *see* detection frequency analysis

- diabetes 1014, 1021, 1036
 diacetyl 88, 104, 107–9, 244
 Diageo group 34, 43
 dialysis 451–2
 diamine oxidases (DAOs) 1100
 diammonium phosphate (DAP) 289, 293, 294, 314
 and atypical ageing 370
 in champagne production 329, 332
 diatomaceous earth 331, 332, 352–3
 dichloromethane 653–4
 Dickel distillery 522, 526–7
 dietary energy requirements 944–5, 963
 dietary fiber 969–70, 1035–6
 in beer 954, 970
 role of phenolic compounds 1035, 1045
 dietary recommendations 944–6, 963
 see also nutrients
 diethyl dicarbonate (DEDC) 1068
 diethylene glycol 38, 639
 differential pulse voltammetry (DPASV) 866, 867
 diffusion ordered spectroscopy (DOSY) 772–3
 α,β -diketones 161
 dimethyl dicarbonate (DMDC) 129, 1068
 dimethyl sulfide (DMS) 154, 369
 in cachaça 563
 3,5-dinitrosalicylic acid method (DNSA method) 806
 1,1-diphenylpyrrolhydrazyl (DPPH) 810–11, 812, 813,
 814
 direct immersion solid phase microextraction (DI-SPME)
 675
 disaccharides 735
 discriminant analysis 644
 disgorging (dégorgement) 335–8
 DI-SPME, *see* direct immersion solid phase
 microextraction
 distillation 457–61
 analytical methods involving 659–64, 900–2
 batch 461–6
 continuous column 466–8
 history of 17, 457–9, 574
 in production of low alcohol beer 450
 multiple 461
 of brandy 578–83
 of cachaça 561–3
 of rum 561–3
 of Scotch whisky 487–91
 theory of 459–61
 distilled beverages
 definition 457
 history of 17, 22–3, 27–8, 574
 nutrient content 955–7
 production areas 9, 10
 phytochemicals in 990
 distillers dried grains (DDG) 498
 distortionless enhancement by polarization transfer
 (DEPT) 769, 773, 777
 diterpenoids 540–1
 DMDC, *see* dimethyl dicarbonate
 DME, *see* dropping mercury electrode
 DMS, *see* dimethyl sulfide
 DNA damage 1001, 1021, 1053
 DNSA method, *see* 3,5-dinitrosalicylic acid method
 doburoku 212
 dohwaju 623
 DON, *see* deoxynivalenol
 Doppelbock beers 198
 Dosoju 623
 DOSY, *see* diffusion ordered spectroscopy
 Douro region 27, 399–400
 downy mildew 26
 DPASV, *see* differential pulse voltammetry
 DPPH, *see* 1,1-diphenylpyrrolhydrazyl
 dPSA, *see* derivative potentiometric analysis
 Drambuie 23, 622
 draught beers 186–92
 dropping mercury electrode (DME) 866–7
 drugs, interactions with alcohol 1010–11
 Dugyeonju 623
 Dumas method 900, 907
 dynamic headspace technique 685–6
 see also purge and trap technique
 eau de vie de cidre 605
 EBCU, *see* European Beer Consumers Union
 ebulliometers 280
 ebulliometry 903
 EC, *see* ethyl carbamate
 Egypt, ancient 13, 15
 EI, *see* electron ionization
 electrochemical methods 855–73
 potentiometric 855–63
 voltammetric 863–8
 see also electrochemical sensors
 electrochemical sensors 869–73
 electrolytes 982–4
 electronic noses 40, 644, 645, 869–70
 electronic tongues 869–71
 electron ionization (EI) 39, 826
 electron spin resonance (ESR) 783–4
 electro-osmotic flow (EOF) 883–4
 electrophoresis 38, 877
 electrophoretic mobility 877

- electrophoretic techniques 877–89
 capillary electrochromatography (CEC) 888, 889
 capillary zone electrophoresis (CZE) 882–8
 gel electrophoresis 878–82
 micellar electrokinetic chromatography (MEKC) 888–9
- electrospray ionization (ESI) 39, 747–8, 826–7
- electrothermal atomic absorption spectroscopy (ETAAS) 815, 816, 818, 819, 820
- ELISA, *see* enzyme linked immunosorbent assay
- ELS, *see* evaporative light scattering
- emission spectroscopy 765
- empilage 337
- energy resolved mass spectrometry (ERMS) 837
- enzyme linked immunosorbent assay (ELISA)
 1100
- enzymes 285–6
- EOF, *see* electro-osmotic flow
- ERMS, *see* energy resolved mass spectrometry
- ESI, *see* electrospray ionization
- ESR, *see* electron spin resonance
- essences 625
- essential oils 625
- esters 89, 110
 in Scotch whisky 500
- estragole 1096
- estufagem 397–9
- ETAAS, *see* electrothermal atomic absorption spectroscopy
- ethanol
 antioxidant enhancing properties 988
 determination of 893, 899, 900
 effect on foaming properties of beer 176
 measurements in wine 280–1
see also alcohol; bioethanol
- ethephon 255
- ethyl acetate 88, 110
- ethyl carbamate (EC) 104, 1104–5
 analytical methods 734
 formation during distillation 468
 in cachaça 563
 in cherry and plum spirits 610, 611
 in cider spirits production 605
 in Scotch whisky 476
- ethyl lactate 106, 110
- 4-ethylphenol 119
- ethyltetrahydropyridine (ETPY) 119
- ETPY, *see* ethyltetrahydropyridine
- European Beer Consumers Union (EBCU) 45, 46
- evaporative light scattering (ELS) 735
- extraction techniques
 for production of essences and essential oils 625–6
 for sample preparation 647–91
- extracts 625–6
- FAAS, *see* flame atomic absorption spectroscopy
- FABs, *see* flavored alcoholic beverages
- FACE, *see* fluorescence assisted carbohydrate electrophoresis
- FAN, *see* free amino nitrogen
- Faro 170, 200
- fat free mass (FFM) 965–6
- feints 490
- Fenton reaction 195–6
- fermentation 65–70, 114
 batch 171
 bottle 249, 331–3
 bottom 167–9
 definition 65
 discovery of nature of 24–5
 high gravity brewing 171
 in beer production 157–73
 in brandy production 576–7
 in cachaça/rum production 560–1
 in cider/perry production 241–5, 255–6
 in Dampfbier production 170
 in lambic beer production 169–70
 in Scotch whisky production 485–7
 in steam beer production 170
 in wine production 292–7, 312–21
 spontaneous 75
 top 163–7
 traditional 32
see also carbonic maceration; continuous fermentation method; alcoholic fermentation; malolactic fermentation
- ferric reducing ability of plasma (FRAP) 810, 812, 813, 814
- 'Fertile Crescent' 13, 15
- ferulic acid 130, 549
- fetal alcohol spectrum disorder 1019
- FFM, *see* fat free mass
- FIA, *see* flow injection analysis
- fiber, *see* dietary fiber
- FID, *see* free induction decay
- film evaporation method 451
- filter aids 180
- filter machines 180
- filtration 179–81, 350–4
- fining 297–8, 345–6
see also fining agents

- fining agents 1068–9
 in beer production 154–5, 176–9
 in cider production 248–9
 in wine production 345–9
 fining trials 349–50
 flame atomic absorption spectroscopy (FAAS) 815, 816, 818–23, 825
 flame photometry 36
 flavan-3-ols 307, 774
 flavonoids 306–7, 361, 369
 flavor wheels 918–19, 920
 flavored alcoholic beverages (FABs) 52–3
 see also alcopops
 flavored beers 199–200
 floc 178
 flocculants, *see* fining agents
 Floc de Gascogne 414–15
 floor malting 136, 479
 flor 21, 119, 387, 391–2
 flor wines 394
 see also Sherry
 flor yeasts 119, 391–2
 flotation 253, 354
 flower liqueurs 623–4
 flow injection analysis (FIA) 889–93
 flow injection techniques 889–95
 fluorescence 765–7
 fluorescence assisted carbohydrate electrophoresis (FACE) 878
 fluoride 986
 fluorometric reactions 794, 798
 fluorometry 794
 foam
 in beer 163, 173, 175–8, 880, 906
 in cider 250, 881, 906
 in sparkling wines 325–6, 338, 340, 880–1
 proteins involved in production 143, 175–6, 181, 250, 801, 881
 foam stability measurements 906
 foam stabilizers 1070–1
 folate 730, 980, 1001
 folic acid, *see* folate
 Folin–Ciocalteu method 36, 799, 893
 food colorants 729–30
 foreshots 490
 formaldehyde 997
 formate 997
 formazin turbidity inits (FTUs) 174
 formic acid, *see* formate
 fortified wines 21–2, 383–414, 957–8
 Fourier transform infrared spectroscopy (FTIR) 784–93
 Fourier transform NMR (FT NMR) 767
 Frangelico 624
 Frankland, Edward (Sir) 25
 FRAP, *see* ferric reducing ability of plasma
 fraud 636–9
 detection methods 781–3, 841–3
 free amino nitrogen (FAN) 274, 288–9, 804, 880
 free induction decay (FID) 768
 free radicals 783–4, 810–13, 943
 ‘French paradox’ 943, 976–7, 989
 freon 11 (trichlorofluoromethane) 652, 689
 freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane) 653
 friabilimeters 138
 fruit beers 199
 see also fruit lambics
 fruit brandies, *see* fruit spirits
 fruit flavored liqueurs 619–20
 fruit flies 116, 119
 fruit lambics 170, 200
 fruit liqueurs 617–19
 fruit spirits 463–4, 602–13
 apple 603–7
 nomenclature 602
 of Central Europe 608–10
 of Eastern Europe 611–12
 pear 603, 607–8
 production areas 602–3, 612
 fruit wines 419
 adjuncts 426–7
 fruits used for 420–4
 nutrient content of 952
 production 423, 424–9
 yeasts for 427–8
 see also country wines
 fruits 420–4, 429–31
 antioxidant properties 813–14, 1052
 see also cider apples; perry pears; wine grapes
 FT NMR, *see* Fourier transform NMR
 FTUs, *see* formazin turbidity inits
 functional elements 984–6
 fungicide residues 1076–82
 determination of 655–6, 668, 708, 751–2, 839
 furans 989
Fusarium spp. 1103
 fusel oils, *see* higher alcohols
 gall bladder stones 1006
 Galliano 621–2
 Gamay 303
 gamju 212, 213

- gas chromatography (GC) 38, 709–22
 carrier gas 709
 detectors 720–2
 fast 719–20
 fused silica capillary columns 713–20
 multidimensional 717–19
 oven 720
 sample injectors 710–13
 gas chromatography-atomic emission detection (GC-AED) 672, 688, 823
 gas chromatography-isotope ratio mass spectroscopy (GC-IRMS) 638, 841
 gas chromatography-mass spectroscopy (GC-MS) 39, 656–7, 825
 gas chromatography-olfactometry (GC-O) 523, 524, 722, 923–5
 gastrointestinal disorders 101–12
 Gay Lussac equation 158
 GBL, *see* γ -butyrolactone
 GC, *see* gas chromatography
 GC-AED, *see* gas chromatography-atomic emission detection
 GC-IRMS, *see* gas chromatography-isotope ratio mass spectroscopy
 GC-MS, *see* gas chromatography-mass spectroscopy
 GC-O, *see* gas chromatography-olfactometry
 Geist 609–10
 gelatine 346–7
 gel electrophoresis 878–82
 gel filtration chromatography (GFC) 740–1
 gel permeation chromatography (GPC) 740–1
 genetic modification (GM) 57–9, 375
 ‘geranium fault’ 100, 111, 128
 Gewürztraminer 269, 275
 GFAAS, *see* graphite furnace atomic absorption spectroscopy
 GFC, *see* gel filtration chromatography
 GHB, *see* γ -hydroxybutyric acid
 gin 535–41, 718–19
 botanicals used in production 538–9
 nutrient content of 957
 origin of word 22
 types of 536–8
 Gin Acts 55, 536
 ginseng 222
 ginseng liqueurs 623
 Glayva 622
 gliadins 1100
 globalization 42–4
 β -glucanases 807
 α -glucans 741
 β -glucans 792, 803–4, 1036
Gluconobacter spp. 116, 117
 glucose 894–5, 968
 D-glucose 803–4
 glucose repression 84
 glutathione 971, 989, 1043
 gluten 971, 1100
 glycerol 85–6, 88, 735, 936
 determination of 893
 glycolysis 66, 80–3, 999
 glycosides 778–9, 1045
 glyoxylate cycle 84
 GM, *see* genetic modification
 GNS, *see* grain neutral spirit
 goryangju 553
 gout 972, 999, 1014
 GPC, *see* gel permeation chromatography
 grain neutral spirit (GNS) 467–8
 grain spirits 543–53
 Chinese 544–7
 Japanese 547–9
 Korean 549–53
 grapes, *see* wine grapes
 grapevines
 beginnings of cultivation 13
 genetically modified 59
see also wine grapes
 graphite furnace atomic absorption spectroscopy (GFAAS) 815, 816, 818–19, 820
 grappa 598, 599
 gravimetric methods 35, 896–900
 gravity scale 158
 Grenache 303
 grist 13
 grubbing 137
 gruit 19
 gruit ale 199
 Gueuze 170, 200
 Guinness 30
 gushing 338, 881, 1103
 gypsum 386–7
 Haber–Weiss reaction 195–6
 haloanisoles 672, 824, 841, 1088–90
 halophenols 824, 1088–90
 hangover 942, 966
 Hansen, Emil Christian 25, 69
Hanseniaspora uvarum 67, 118
 hard cider 52
 hazes
 in beer 173–5, 176, 178, 906

- in wine 274, 343, 881–2
 measurements of 906
HCy, *see* homocysteine
 heading down boards 319–20
 headspace methods 685–8
 headspace solid phase microextraction (HS-SPME) 669
 headspace sorptive extraction (HSSE) 683
 heat treatment 317
Hennessy, Richard 28
Henry's Law 190–1
 herbaceousness 310
 herbal liqueurs 620–3
 herbicide residues 677, 1076–82
HETCOR, *see* heteronuclear correlation spectroscopy
 heterocyclic acetals 398
epi-heterodendrin 773, 774
 heteronuclear correlation spectroscopy (HETCOR) 769, 770, 771, 773
 heteronuclear multiple quantum coherence spectroscopy (HMQC) 769, 771, 772
 high carbohydrate beers 1034–5
 higher alcohols (fusel oils) 86, 89, 276, 599–600, 936
 high gravity brewing 171
 high gravity mashing 448–9
 Highland region 503, 504–9
 high performance liquid chromatography (HPLC) 688, 722–4
 applications 724
 capillary 889
 chiral 741–2
 column switching techniques 743–5
 derivatization 731–5
 monolithic silica based phases 746
 narrow bore columns 745
 radial compression technology 745–6
 reversed phase 724–30
 stationary phase selection 723
 high performance liquid chromatography-Fourier transform infrared spectroscopy (HPLC-FTIR) 790
 high performance liquid chromatography-inductively coupled atomic emission spectroscopy (HPLC-ICPAES) 823
 high performance thin layer chromatography (HPTLC) 706–8
 high speed counter current chromatography (HSCCC) 752–4
 high vacuum evaporation (HVE) 843
 high voltage paper electrophoresis (HVPE) 877
 histamine 1098–10
 determination of 888
 HMBC, *see* homonuclear multiple bond coherence spectroscopy
HMQC, *see* heteronuclear multiple quantum coherence spectroscopy
 homocysteine (HCy) 733, 978
 homonuclear multiple bond coherence spectroscopy (HMBC) 769, 771, 773, 774, 777, 779, 780
 honey 17, 622
 honey beers 200
 honey wine, *see* mead
 hopback 154
 hops 150
 aroma compounds 150–2
 bittering agents 150–2, 808–9, 1097
 determining freshness 152
 introduction into brewing 18, 19
 pellet form 152
 varieties 151
 hordeins 1100
 hot trub 149, 154
H.P. Bulmer 33, 257–8
HPLC, *see* high performance liquid chromatography
HPLC-FTIR, *see* high performance liquid chromatography-Fourier transform infrared spectroscopy
HPLC-ICPAES, *see* high performance liquid chromatography-inductively coupled atomic emission spectroscopy
HPTLC, *see* high performance thin layer chromatography
HSCCC, *see* high speed counter current chromatography
HSQC 772, 777, 780
HSSE, *see* headspace sorptive extraction
HS-SPME, *see* headspace solid phase microextraction
 humic substances 479, 482–3
 humulene 152
 humulones 1097
HVE, *see* high vacuum evaporation
HVPE, *see* high voltage paper electrophoresis
 hydrogen peroxide 1041, 1042
 hydrogen sulfide 91, 368–9
 hydrometers 903–4
 γ -hydroxybutyric acid (GHB) 443–4
 hydroxycinnamic acids 130, 886
 3-hydroxy-4,5-dimethyl-2(5H)-furanone, *see* sotolon
 hydroxyl radicals 195, 1041
 hypersensitivity 1013
 hyperuricaemia 999, 1014
 hypoglycaemia 999, 1014
IAA, *see* indole-3-acetic acid
IBUs, *see* International Bittering Units

- ice stabilization 178
 ICP, *see* inductively coupled plasma
 ICPAAS, *see* inductively coupled atomic absorption spectroscopy
 ICPAES, *see* inductively coupled atomic emission spectroscopy
 ICPMS, *see* inductively coupled plasma-mass spectrometry
 IDMS, *see* isotope dilution mass spectrometry
 IMFL, *see* Indian-Made Foreign liquors
 immobilized cell methods 256
 Indian-Made Foreign liquors (IMFL) 531–2
 indole-3-acetic acid (IAA) 370
 inductively coupled atomic absorption spectroscopy (ICPAAS) 815
 inductively coupled atomic emission spectroscopy (ICPAES) 815, 816, 823, 824–5
 inductively coupled plasma (ICP) 816, 823
 inductively coupled plasma-mass spectrometry (ICPMS) 815, 816, 840–1
 industrial contaminants 1086–90
 infrared (IR) spectroscopy 37, 784–93
 mid IR (MIR) 787
 near IR (NIR) 786, 787, 788, 789, 792
 visible-near IR (Vis-NIR) 789
 infusion techniques 425
 inns 18
 insecticides, *see* residues, pesticides
 insects 310
 International Bittering Units (UBI) 153
 International Wine Challenge (2006) 278, 299
Inula helenium 621, 1095
 ion chromatography 735–9
 ionization 38–9, 826–8
 ion selective electrodes (ISE) 857–60, 869
 ion trap analyzers (QIT) 828–30
 Irish Cream 625, 957
 Irish Distillers 516
 Irish Mist 622
 Irish moss 154, 177
 Irish whiskey 516–19
 categories of 517
 differentiated from Scotch whisky 23, 516
 IRMS, *see* isotope ratio mass spectrometry
 iron
 determination of 807, 821, 822–3
 ferrous 807
 nutritional values 985
 total 807
 IR spectrophotometers 37
 ISE, *see* ion selective electrodes
 isinglass
 detection of 734
 health concerns 1069
 in cask-conditioned ales production 178–9
 in wine production 347–8
 Islay region 509–10
 ISO 9000 634
 isoprenoids 1095
 isoprostanes 1054–5
 isothermal membrane perstration 451
 isotope dilution mass spectrometry (IDMS) 840
 isotope ratio mass spectrometry (IRMS) 781, 783, 841–3
 in fraud detection 637–8
 isovaleric acid 119
 Jack Daniel distillery 522, 526
 jacking 23
 Jägermeister 621
 jiannanchun 546
 Joule, James Prescott 24
 Jugyeopcheongju 623
 juniper flavored spirits 535–40
 keeving 241, 249, 253, 256
 keg beers 189–90
 kegs 30, 184–5
 Kent beer 57, 58
 kettles 149
 kidney stones 1006
 killer proteins 882
 kir 617–18
 Kirsch 609
 Kjeldahl, Johan 25
 Kjeldahl method 25, 35, 900, 907
Kloeckera apiculata 67, 118
 koduölü 204
 koji 547–8
 Kölsch 200
 Korn 515, 527, 533
 ‘krausening’ technique 168
 Kreb’s cycle, *see* tricarboxylic acid cycle (TCA)
 Krupnikas 622
 Kümmel 623
 label fraud 637
 labeling legislation 1032–3
 lacing 175
 lactic acid 803
 lactic acid bacteria (LAB) 69
 causing wine spoilage 111, 117
 in Scotch whisky production 485–6

- malolactic bacteria strains 97–100, 106
see also malolactic fermentation
- lactic souring 111
- lactic spoilage 111, 117
- Lactobacillus* spp. 111, 117, 485–6
- lager 25, 167–9
- lagering 168
- lambanog 566
- lambic beer 45, 169–70, 200
 fruit 170, 200
- Lambrusco 341
- Lane–Eynon method 803, 898
- Lavoisier, Antoine Laurent 24
- LC, *see* liquid chromatography
- LC-MS, *see* liquid chromatography-mass spectroscopy
- LD, *see* limit dextrinase
- lead
 as preservative in wine 26
 determination of 818–20, 840, 866, 891
- lead acetate 26, 638
- least squares support vector machines (LS-SVM)
 789–90
- Leuconostoc oenos*, *see* *Oenococcus oeni*
- licensed premises 18
- light 363–4
- light scattering methods 906
- light struck 338, 363–4
- Lillet 444
- limit dextrinase (LD)
 estimation of activity 806
 in production of low carbohydrate beers
 1033
 in production of Scotch whisky 484–5
- limited fermentation methods 448–9
- limoncello 619, 620
- Lincoln County process 521, 526
- Lintner units 898
- lipids 972–3
- liqueur de tirage 331
- liqueur d'expédition 336, 337
- Liqueur Fogg 624
- liqueur Muscat wines 413–14, 615
- liqueurs 616–26
 cherry 616, 618
 coco 624
 coffee 624
 cream 624–5
 definition of 615
 essences and concentrates for 625–6
 flower 623–4
 fruit 617–19
- fruit flavored 619–20
- history of 23, 616
- Korean 623–4
- nut 624
- nutrient content 957
- orange 619
- production methods 615
- tea 624
- liqueur wines (*vins de liqueur*) 383, 414–15
- liquid chromatography (LC) 38, 722–52
- liquid chromatography-mass spectroscopy (LC-MS) 39,
 747–52, 825, 831–9
- liquid extraction techniques 648–58
- liquid–liquid extraction (LLE) 649–55, 689, 690
- liquid solid extraction (LSE) 664
- liver disease 1011, 1012–13
- LLE, *see* liquid–liquid extraction
- Lochristian Ora 622
- Lomond stills 462
- Lovibond, Joseph William 35–6
- Lovibond colorimeter 794
- Lovibond scale 794
- low alcohol beverages 447–53
 beers 30, 447–52, 964
 wines 33, 375–6, 452–3
- low carbohydrate beers 54, 1033–4
- low impact odorants 924–5
- Lowland region 502–4
- low wines 490
- LSE, *see* liquid solid extraction
- LS-SVM, *see* least squares support vector machines
- Lulio, Raimundo 616
- maceration 242
 carbonic 33, 312–13
- Mackinnon, John 23
- macronutrients 961–73
 alcohol 966–7
 carbohydrates 967–70
 lipids 972–3
 nitrogenous compounds 970–2
 typical values 961–2
 water 963–6
- Madeira 21–2, 395–9
- maeshilju 618
- magnesium 985
- magnetic nuclei 767
- maguey plants, *see* *Agave*
- maguey worms 568
- Maibockbier 198
- Maillard reaction 140, 141–2, 752, 779, 838

- maize
 fermented drinks based on 224–5
 for Scotch whisky production 477–8
- makkoli 212–13, 216
- Málaga 409
- Mallory–Weiss syndrome 1011
- malnutrition 1015–16
 see also nutrients, deficiencies
- malolactic bacteria
 factors affecting growth 98–100
 identification of 98
 morphology and physiology 97–8
 production of biogenic amines 106
 the term 97
- malolactic fermentation (MLF) 32–3, 69, 96–111
 by-products of 107–10
 effects on wine 104, 106–11
 finishing 105
 growth of bacteria population 102
 in cider/perry 243–5, 247, 255–6
 inoculation with starter culture 101–2
 in red wines 321
 interactions between bacteria and other organisms 100
 in white wines 297
 lactic spoilage 111, 117
 microbial stability 104–5
 monitoring 105
 partial 102
 preventing 105
 process 103–4
 production of biogenic amines 106
 production of diacetyl 104
 spontaneous 101
 see also malolactic bacteria
- malt 13
 malting
 in beer production 134–43
 in Scotch whisky production 479–83
 of buckwheat 142
 of sorghum 142
 malting loss 140
 maltodextrins, *see* α-glucans
 malvidin 3-glucoside 404, 754, 798, 877–8
- Malzbier 201
- Manchester beer epidemic 35
- manganese 821, 822
- MAOs, *see* monoamine oxidases
- Marangoni current 918
- Marangoni effect 906
- marc 328
- Marchiafava–Bignami syndrome 1017
- Markham apparatus 902
- Marsala 408–9
- Märzenbier 201
- mashing
 in beer production 143–8
 in Scotch whisky production 483–5
- mass spectrometry (MS) 37, 38–9, 825–43
 analyzers 828–30
 applications 831–41
 ionization techniques 826–8
 tandem 830–1
- masticka 570
- maturation
 distinguished from ageing 354–5
 factors affecting 355–66
 in apple spirits 606
 in brandy 583–5
 in Champagne 333–4
 in Scotch whisky 491–5
 in wine 321–2, 354–66
 see also ageing
- MBRs, *see* membrane bioreactors
- MDGC, *see* multidimensional gas chromatography
- mead 17, 432–4
- MEKC, *see* micellar electrokinetic chromatography
- melanoidins 175, 195
- melatonin 972
- melon liqueurs 619
- melon spirits 613
- membrane bioreactors (MBRs) 256
- MEOS, *see* microsomal ethanol oxidizing system
- MEPS, *see* microextraction in packed syringe
- Merlot 302
- metabisulfite 252
- metabolic syndrome 1016
- metal ions, 1082–6
 allowed limits 1084–5
 determination of 807–8, 816–23, 840, 856, 861, 862–3, 866–7, 891
 methods of removal 1086
- methanol 638, 997, 1016
- methional 398, 502
- Méthode Traditionnelle 324–38
- methoxypyrazines (MPs) 364
- S-methyl methionine (SMM) 155
- Mexican Kahlúa 624
- mezcal 567–70
 additions to 568
 categories of 568
 determining authenticity 638
- micellar electrokinetic chromatography (MEKC) 888–9

- microbreweries 31, 44–5
 definition 46
- microdistillation 592
- microextraction in packed syringe (MEPS) 667
- micronutrients 975–90
 electrolytes 981–4
 functional elements 981–2, 984–6
 phytochemicals 986–90
 vitamins 977–81
- microoxygenation 284, 357, 780
- microsomal ethanol oxidizing system (MEOS) 995–6
- mid IR spectroscopy (MIR) 787
- miji 213
- mild ales 201
- Millardet, Pierre-Marie-Alexis 26
- Millevielle 623
- millet 142, 222 478
- millet wine 16
- minerals 981–2
 see also electrolytes
- MIR, *see* mid IR spectroscopy
- mirabelle 608
- MLCCC, *see* multilayer coil counter current chromatography
- MLF, *see* malolactic fermentation
- modified wort method 448
- molasses 560
- molds 120
 control of 372
 effect on fermentation 69–70
 role in cork-taint problem 70, 120
- monasteries
 production of herbal liqueurs 620, 622
 role in alcoholic beverage production 17, 18, 20, 23
- monitoring 634–5
- monoamine oxidases (MAOs) 1100
- monosaccharides 967
- Montilla-Moriles wines 394, 729
- Monti process 371
- 'mother of vinegar' 115
- mouro 612–13
- mouse taint 111, 119
- MPs, *see* methoxypyrazines
- MS *see* mass spectrometry
- MS/MS, *see* tandem mass spectrometry
- multidimensional gas chromatography (MDGC) 717–19
- multilayer coil counter current chromatography
 (MLCCC) 753–4
- multinational companies 42–4
- munbaeju 553
- Münchner 201–2
- Muscat 269–70, 275
- Muscat vins doux naturels 410–12, 413
- muscle 1016–17
- Musu Crema de Pacharan 625
- mycotoxins 708, 734, 752, 839, 1101–4
- myrcene 152
- natamycin 130
- NCCs, *see* nonfluorescent chlorophyll catabolites
 'near beer' 29, 447
- near IR spectroscopy (NIR) 786, 787, 788, 789, 792
- nephelometric turbidimeters 906
- nephelometric turbidity units (NTU) 906
- nervous system disorders 1017–18
- Nessler's reagent 804
- niacin (vitamin B3) 979
- NIR, *see* near IR spectroscopy
- nitrogen
 compounds in wine grapes 274–5
 total content 804–5, 900, 907
 see also free amino nitrogen (FAN); yeast-assimilable nitrogen (YAN)
- nitro-PAPS reagent 807
- N*-nitrosamines 669, 1105–6
- N*-nitrosodimethylamine (NDMA) 1105–6
- NMR, *see* nuclear magnetic resonance
- NMR spectrometers 37
- noble rot 70, 88
- NOE, *see* nuclear Overhauser effect
- NOED, *see* nuclear Overhauser effect difference spectroscopy
- noenzymic browning 140
- NOESY, *see* nuclear Overhauser effect spectroscopy
- nonalcoholic beers 30
- nonalcoholic beverages 30, 447
 see also low alcohol beverages
- trans*-2-nonenal 195
- nonflavonoids 306, 361
- nonfluorescent chlorophyll catabolites (NCCs) 1093–4
- norisoprenoids 1095
- nosing 495–6, 925
- NTU, *see* nephelometric turbidity units
- nuclear magnetic resonance (NMR) 37, 39, 767–84
 ^{13}C 771, 772, 773, 774, 777, 781
 ^1H 771, 773, 774, 777, 780
 ^2H (deuterium) 781
 applications 771–84
 continuous wave 767
 experiments 769
 Fourier transform 767
 techniques 769–73

- nuclear Overhauser effect (NOE) 771, 773
 nuclear Overhauser effect difference spectroscopy (NOED) 769, 771, 773, 777
 nuclear Overhauser effect spectroscopy (NOESY) 769, 771, 773, 777
 nucleotides 972
 nuruk 214–15
 nut liqueurs 624
 nutrients
 deficiencies 1000–1, 1015–16
 essential 944
 factors influencing content 941–3, 949–59
 in beer 952–5
 in cider/perry 955
 in distilled beverages 955–7
 in fortified wines 957–8
 intake recommendations 944–6
 in wines 951–2
 see also macronutrients; micronutrients
- oak barrels 33
 oak chips 33, 255, 585
 oak treatment 322
 OAWs, *see* odor activity values
 obesity 1000, 1007, 1016, 1030, 1060
 Ochratoxin A (OTA) 372, 1102–3
 analytical methods 734–5, 746, 752, 888
 odor
 description of 918–19
 perception of 917–18, 922–5
 see also aroma compounds
 odor activity values (OAWs) 923
 odor threshold values (OTVs) 648, 922
Oenococcus oeni 69, 96, 98, 100, 101, 103
 °Oeschle scale 272
 Ogalpaju 623
 old ales 202
 olfaction 916–19, 922–5
 olfactory system 914–16
 oligosaccharides 967
 OPLC, *see* overpressured layer chromatography
 ORAC, *see* oxygen radical absorbance capacity
 orange liqueurs 619
 organic beers 33, 56
 organic wines 33, 56
 organoleptic analysis, *see* sensory analysis
 organotin compounds 1090
 origin, determination of 781–3, 823, 840
 orthogonal signal correction (OSC) 792
 orujo 598, 599, 600
OSC, *see* orthogonal signal correction
 osmotic distillation 353–4
 osteoporosis 1006, 1018
 OTA, *see* Ochratoxin A
 OTVs, *see* odor threshold values
 ouzo 570–1
 overoxidation 115
 overpressured layer chromatography (OPLC) 706, 707
 oxidation
 and Scotch whisky ageing 492
 and staling of beer 192–6
 in Sherry wines 391–4
 see also oxygen; oxidative ageing
 oxidative ageing 384, 393, 406
 oxidative stress 1038–9
 oxygen
 in cell metabolic process 1039–41
 incomplete reduction of 1041–3
 monitoring 374–5, 809–10, 868
 role in wine maturation and ageing 355–7
 toxicity 1038
 oxygen electrodes 868
 oxygen radical absorbance capacity (ORAC) 812
 pacharan 625
 PAHs, *see* polycyclic aromatic hydrocarbons
 pale ales 202–3
 palm wine 228–9
 pancreatic disease 1018
 pantothenic acid (vitamin B5) 979
 paper chromatography 38
 parameters 634–5
 partial least squares (PLS) analysis 496, 643, 644–5, 787, 789
 partial least squares regression (PLSR) 787, 790, 792
 Pasteur, Louis 24–5
 Pasteur effect 81
 pasteurization 25
 of beer 181
 of wine 275
 pasteurization unit (PU) 181
 pastis 34, 571, 572
 patulin 1103–4
 PCA, *see* principal component analysis
 PCBs, *see* polychlorinated biphenyls
 pear juice concentrate 252, 254
 pear spirits 603, 607–8
 pear wines 232
 peat 479, 482–3
 analytical methods 792–3
 pectins 273, 1051
 pectolytic enzymes 275, 285, 427

- Pediococcus* spp. 111, 117
 pentose phosphate pathway 84–5
 peptides 881, 971
 Pérignon, Dom 21
 perlite 353
Pernod-Ricard 34, 43
 peroxidases 1043
 perry 33, 231–63
 - bottle-conditioned 247
 - cask-conditioned 247
 - crushing process 239–40
 - distinguished from pear wines 232
 - fermentation processes 241–5, 255–6
 - flavored 255
 - history of 231
 - large-scale production 251–4
 - nutrient content 955
 - prefermentation treatments 241, 256–7
 - pressing process 240–1
 - production areas 3–5, 257–63
 - revival 52
 - traditional/small-scale production 239, 245–51
 - yeast strains 241, 247, 251
 - see also* perry pears
- perry pears 232, 233–8
 - classification of 233–4
 - harvesting 238–9
 - phenolic compounds in 234, 236–7
- Persepolis 12
 pervaporation 892
 pesticide residues 1076–82
 - acute toxicities (LD_{50}) 1077
 - determination of 656, 668–9, 677, 708, 751, 839
 - maximum residue limits (MRLs) 1077
- PET bottles 193, 376–7, 1090
 petillants 325
 PGA, *see* propylene glycol alginate
 pH measurements 37, 280, 859–60
 - see also* acidity
- phthalates 669, 678
 phenolic acids 109, 423
 phenolic compounds 1044–50
 - analytical methods 707–8, 728–9, 749–50, 753–4, 773–7, 791, 831–7, 886–7
 - and dietary fiber 1035, 1045
 - antioxidant properties 987–9, 1043–4, 1051–60
 - binding to proteins 781, 837, 882, 921–2, 1049
 - chemical characteristics 1045–50
 - health benefits 988–9
 - in beer 150
 - in cider apples 233, 234–7
- in fruits for winemaking 420–3
 in perry pears 234, 236–7
 in Port 404–5
 in Scotch whisky 500–2
 in Vermouth 442–3
 in wine 304–9
 - in wine grapes 273–4
 - mechanisms of health benefits 1054–60
 - role in wine maturation and ageing 360–1
 - types of 1044–8
 - see also* anthocyanins
- phenolic extraction 315–20
 phosphate 808
 phosphorus 985
 phthalate esters 1090
 phylloxera 26, 395
 physical methods 896–907
 phytochemicals 986–90, 1093–7
 - in beer 990
 - in distilled spirits 990
 - in wine 989–90
- phytoestrogens 987
Pichia spp. 118
 pigments
 - analytical methods 706, 707, 709, 754, 773–4, 777, 797, 825, 834
 - anthocyanin-derived 428–9, 754, 814
 - brown 284
 - see also* anthocyanins
- Pilsener 203
 pimaricin 130
Pineau de Charentes 414
Pinotage 302, 754
 pinotin A 754
Pinot Noir 302, 312, 315
 pisco 591–2
 pitching 159
 pK_a values 797–8, 877–8
Planchon, Jules Émile 26
 °Plato scale 158
PLS, see partial least squares (PLS) analysis
PLSR, see partial least squares regression
 plum liqueurs 618
 plum spirits 610, 611–12
 plunging 318–19
 podoju 618
 poignetage 334
Poitín 517
 polarography 866–8
 polyacrylamide gel electrophoresis (PAGE) 878
 polyamines 708

- polychlorinated biphenyls (PCBs) 1088
 polycyclic aromatic hydrocarbons (PAHs) 1088
 polyphenols 1044–5
 see also phenolic compounds
 polysaccharides 791–2, 967
 polyvinylpolypyrrolidone (PVPP) 177, 289, 349, 1069
 polyvinylpyrrolidone (PVP) 177, 1069
 pomace 240–1, 595
 pomace spirits 595–600
 production 596–8
 sensory characteristics 599–600
 types of 598–600
 Pomagne 265, 257
 pommeau 260, 383, 415
 Port 26–7, 399–408
 aroma compounds 405–6
 phenolic compounds 404–5
 types of 407
 porter 25, 203–4, 206
 Port style wines 407–8
 potassium 982
 potassium ferrocyanide 1070
 potentiometric methods 855–63
 ion selective electrodes (ISE) 857–60
 potentiometric stripping analysis (PSA) 860–3
 pot stills 459, 462, 466, 487–90
 powdery mildew 26, 121
 see also molds
 pregnancy 1019
 preservatives 26, 123–30, 887, 889, 1065–8
 principal component analysis (PCA) 643–4, 787, 788, 792
 proanthocyanidins 777
 processed beer, *see* brewery-conditioned beer
 process monitoring 633–6
 procyanidins 799–800
 prohibition 29, 1004
 prolamins 1100
 propylene glycol alginate (PGA) 1070–1
 Prosecco 341
 proteins
 analytical methods 741, 751, 788–9, 805, 838–9, 878–82
 binding to phenolic compounds 781, 837, 882, 921–2, 1049
 involved in foam production 143, 175–6, 181, 250, 801, 881
 nutritional value 970–2
 thaumatin-like 741
 see also killer proteins
 Prussian Blue based sensors 872, 894
 PSA, *see* potentiometric stripping analysis
 psychological disorders 1017–18
 PU, *see* pasteurization unit
 pubs, origin of pictorial signs on 19
 pulque 16, 226–8
 pumping over 319
 punching down, *see* plunging
 pupitre 334
 purge and trap technique 686–8
 PVC containers 1090
 PVP, *see* polyvinylpyrrolidone
 PVPP, *see* polyvinylpolypyrrolidone
 pycnometers 904
 pyranoanthocyanins 774, 776
 pyrazines 546–7
 pyridoxine (vitamin B6) 979
 pyrocarbonates 1068
 ‘python’ 189
 QA, *see* quality assurance
 Q analyzers, *see* quadrupole analyzers
 QC, *see* quality control
 QIT, *see* ion trap analyzers
 quadrupole analyzers (Q) 828–9
 quadrupole ion traps, *see* ion trap analyzers (QIT)
 quality, defining 633–4
 quality assurance (QA) 634
 quality control (QC) 634
 beer 19
 brandy 592–3
 methods for 786–7, 789
 quinquinas 442, 444
 racking 344
 radial compression technology 745–6
 radical scavenging 1049, 1051–2
 railways 24
 Raman spectroscopy 793
 Raoult’s Law 459
 ratafia 414
 Rauchbier 204
 RCGM, *see* rectified concentrated grape must
 RDT, *see* ready to drink
 reactive nitrogen species (RNS) 1038
 reactive oxygen species (ROS) 1038–9, 1041–3
 ready to drink (RTD), 52–3
 see also alcopops
 Rebelein method 36, 803
 rectified concentrated grape must (RCGM) 290
 red beers 204
 red marine alga (*Chondrus crispus*) 154

- reductones, 140, 864
 red wine 300–24
 acidity adjustments 312
 barrel maturation 321–2
 bottle aging 322–3
 carbonic maceration 33, 312–13
 color changes 367, 402–4
 crushing process 310–11
 destemming process 310–11
 fermentation 314–15
 grape varieties for 300–4
 harvesting procedures 309–10
 lacquer-like bottle deposits 781–2
 malolactic fermentation 321
 ‘Monti’ process 371
 nutrient content 952
 phenolic compounds 304–9
 phenolic extraction 315–20
 pressing fermenting pulp 320
 sulfur dioxide additions 311–12
 yeast strains 313–14
 reflux columns 462
 refractive index measurements 907
 refractometers 279, 907
 refrigeration 24, 25
 Reinheitsgebot 636
 remuage, *see* riddling
 reproductive capacity 1019
 residues 1076–90
 industrial organic contaminants 1086–90
 metal and nonmetal contaminants 1082–6
 pesticides 655–6, 668–9, 677, 708, 751–2, 839,
 1076–82
 resistive heating gas chromatography (RH-GC) 720
 respiration 65–6, 84–5
 respiratory system 1019
 restriction fragment length polymorphism (RFLP) 879
 resveratrol 1051, 1053, 1058–60
 analytical methods 707, 746, 750, 835, 886, 887
 retsina 436, 444, 445
 reverse osmosis (RO) 33, 354, 843
 in production of low alcohol beverages 451–2
 reverse phase high performance liquid chromatography
 (RPHPLC) 724–30
 RFLP, *see* restriction fragment length polymorphism
 RH-GC, *see* resistive heating gas chromatography
 riboflavin (vitamin B2) 978–9
 rice wines 211, 212–22
 brewing procedure 212, 214–16
 Chinese 219–20
 cloudy 212–13
 flavored 221–2
 history of 16, 19–20, 31–2, 34
 Japanese 31, 216–19
 Korean 31–2, 34, 214–16, 221–2
 refined 213–14
 starters 222
 types of 212–14
 Vietnamese 220–1
 riddling (remuage) 334–5
 Riesling 270, 275, 753–4
 Riley, Charles Valentine 26
 Ripper method 128, 899
 RNS, *see* reactive nitrogen species
 RO, *see* reverse osmosis
 Roggenbier 204
 Romans, the 13, 14, 16, 26
 ‘ropey’ wines 106–7, 111
 ROS, *see* reactive oxygen species
 rose petals liqueurs 623
 rosé wines 323–4, 330, 367, 952
 rotundone 727
 RPHPLC, *see* reverse phase liquid chromatography
 rum 23, 556–60
 ageing 563–4, 565
 distillation 561–3
 fermentation 560–1
 flavor characteristics 564–6
 nutrient content 957
 origin of word 556–7
 production areas 556, 558–9
 production method 559–60
 waste products 564
 rye whiskey 527–8
 SAB Miller 43
 Sabra 624
 saccharimeters 35
Saccharomyces carlsbergensis 25, 69
Saccharomyces cerevisiae 67, 68, 72–5, 76, 87
 in control of molds 372
 in production of low alcohol beers 449–50
Saccharomyces ludwigii 450
Saccharomyces ovatum 69
Saccharomyces uvarum 167
 SAFE, *see* solvent assisted flavor evaporation
 sahti 204
 saison 205
 sake 213, 216–19
 history of 16, 19–20, 31
 see also shochu
 Sake Meter Value (SMV) 218–19

- saliva
 in beverage production 16–17, 225
 influence on aroma release 673, 918
 influence on astringency 882, 921–2
- sambuca 571, 572, 623
- sample preparation 647–91
 combination of methods 688–90
 distillation methods 659–64
 headspace methods 685–8
 liquid extraction techniques 648–58
 solid phase extraction techniques 664–85
- Sassolino 623
- Sauvignon Blanc 268–9, 275, 654
- SBSE, *see* stir bar sorptive extraction
- SCC method, *see* spinning cone column method
- Schnaps 602
see also fruit spirits
- Scotch ales 205
- Scotch whisky 469–512
 blended 28, 34
 blending 495
 bottling 497–8, 511–12
 casks used for ageing 491–2
 changes/innovations in production 472–3
 changes in pattern of consumption 34
 cooking process 483–4
 differentiated from Irish whiskey 23, 516
 distillation 487–91
 fermentation 485–7
 filtration 497
 flavor compounds in 498–502
 grain 28, 484, 490, 510–11
 history of 27–8, 470
 locations of distilleries 470–1
 malt 28, 34
 malting process 479–83
 mashing process 483–5
 maturation 491–5
 packaging 497–8
 phenolic compounds in 500–2
 production processes 473–4
 protective legislations 472
 raw materials 475–9
 sensory evaluation 495–6, 925–6
 single malt 34, 495
 single malt whisky regions 502–10
 smokiness 482–3
 vatted malt 495
 waste products 498
 water for 478–9
- screw caps 365–6, 369
- scrumpy 247
- SDE, *see* steam distillation-extraction
- SDUs, sorghum diastatic units
- SEC, *see* size exclusion chromatography
- sedimentation 344
- selected ion monitoring (SIM) 748
- selenium 986
- self-regeneration suppression (SRS) 737
- seniphos 255
- sensory analysis 913–30
 guidelines and information 914
 olfaction 914–19, 922–5
 sensory tests 925–30
 taste 919–22
- sequential injection analysis (SIA) 895
- sesquiterpene lactones 1095
- SFE, *see* supercritical fluid extraction
- Sherry 21, 384–93
 flor 21, 119, 387, 391–2
 grape varieties 384–5
 oxidative ageing 393
 production areas 384, 385
 production method 386–90
 types of 384–5, 387–8
- Sherry style wines 390–1
- Shiraz 301
- shochu 547–9
- SIA, *see* sequential injection analysis
- SIBA (UK), *see* Society of Independent Brewers
- SIBA (USA), *see* Brewers Association
- silica hydrogels 1069
- silica sol 349
- silicon 824, 986
- SIM, *see* selected ion monitoring
- site-specific natural isotopic fractionation NMR (SNIF-NMR) 39, 637, 781–3
- size exclusion chromatography (SEC) 740–1
- skin contact 285
- skin disorders 1019
- slivovitz 611–12
- Śliwowica Łącka 612
- sloe brandy 619
- sloe gin 618–19
- ‘small beer’ 964
- SMM, *see* S-methyl methionine
- SMV, *see* Sake Meter Value
- SNIF-NMR, *see* site-specific natural isotopic fractionation NMR
- Society for Preservation of Beer from the Wood (SPBW)

- Society of Independent Brewers (SIBA) 45, 46
 SOD, *see* superoxide dismutase
 sodium 982–3
 sodium alginate 348
 sodium dodecyl sulfate-polyacrylamide gel electrophoresis (SDS-PAGE) 838, 878–82
 soju 23, 31, 34, 214, 549–53
 solera system 388–90
 solid phase extraction (SPE) 39, 655, 664–85
 solid phase microextraction (SPME) 39, 654–5, 657, 669–78, 684
 direct immersion (DI-SPME) 675
 extraction efficiency 678–80
 headspace (HS-SPME) 669
 solvent assisted flavor evaporation (SAFE) 662–4
 Songsunju 623
 sorbic acid 100, 111, 120–1, 128–9, 1067–8
 analytical methods 727, 887, 889, 895
 Sørensen, Søren Peder Lauritz 25
 sorghum
 analysis of protein 881
 fermented drinks based on 222–5
 for Scotch whisky production 478
 malting 142
 sorghum diastatic units (SDUs) 899
 sorption techniques 39, 664–85
 sorptive extraction 678
 see also stir bar sorptive extraction (SBSE)
 sotolon (3-hydroxy-4,5-dimethyl-2(5H)-furanone) 220, 369, 392, 405–6, 412–13, 655
 Sourish Shchi 205
 South America, fermented drinks of 225–8
 Soxhlet extraction 625–6
 sparging 144
 sparkling wines
 carbon dioxide impregnation 339–40
 continuous process 342–3
 definition 324–5
 faults in 338–9
 foaming properties 325–6, 338, 340, 880–1
 nutrient content of 952
 sugar enrichment analysis 841–3
 tank fermentation (Charmat process) 340–1
 transfer process 342
 see also Champagne
 SPBW, *see* Society for Preservation of Beer from the Wood
 SPE, *see* solid phase extraction
 spectral vineyard imaging 372–3
 spectrophotometers 36, 794
 spectroscopic methods 765–843
 atomic spectroscopy 814–25
 infrared spectroscopy 784–93
 mass spectrometry 825–43
 nuclear magnetic resonance (NMR) 767–84
 UV-visible spectroscopy 793–814
 spent grain method 448
 Speyside 506–9
 spinning cone column method (SCC) 452–3
 spirits, *see* distilled beverages
 SPME, *see* solid phase microextraction
 spoilage organisms 69–70
 in beer 114, 117–18
 in wine 114–21
 spontaneous fermentation 75
 see also ‘wild’ yeasts
 square wave anodic stripping voltammetry (SWASV) 866
 SRS, *see* self-regeneration suppression
 stainless steel vessels 32
 stalting 192–6
 star anise (*Illicium verum*) 441, 571, 623, 814
 static headspace technique 685
 statistical methods 643
 steam beers 170, 205
 steam distillation extraction (SDE) 659–62, 682
 steam engines 24
 Steinbier 206
 Steiner, Rudolf 56
 Steinhäger 536
 Stevia *Rebaudiana* 550
 stevioside 550
 stillage 485, 491
 stills
 alembic 17, 458, 465
 batch column 462–4, 466
 Coffey 28, 458, 466
 continuous (column) 458–9, 466–7
 for Scotch whisky production 487–90
 history of 458–9
 Lomond 462
 pot 459, 462, 466, 487–90
 stir bars 680–1
 stir bar sorptive extraction (SBSE) 39, 662, 674, 678–84
 stock ales 202
 stout 25, 206, 985
 St. Raphael 444
 Strega 621, 622
Streptomyces natalensis 130
 stripping voltammetry 865–6
 strobins 1080
 strong ales 202

- sugar cane 557
 sugar cane spirits, *see* cachaça; rum
 sugar enrichment analysis 841–3
 sugars, determination of 727, 803–4, 872, 893, 894
 sulfates 359, 899–90, 953, 983–4
 sulfides 91, 293
 sulfites 359, 374, 984
 acceptable daily intake (ADI) 1067
 determination of 867, 870, 888, 894, 895
 health concerns 1066–7
see also sulfur dioxide
 sulfur dioxide 123–8, 1065–8
 addition to red wines 311–12
 addition to white wines 296
 alternatives to 359, 374
 determination of 865, 867–8, 894, 895, 899, 902–3
 effect on malolactic bacteria in wine 99
 effects on wine maturation and ageing 358–9
 free/bound forms 124–5, 1066
 health concerns 128, 1066
 in Champagne production 328, 332
 permitted levels in wines 128, 296, 358–9, 1066–7
 measurements of 128, 280
 roles of 120, 125–8
 use in ancient times 18, 26
- Suntory 34
 supercritical fluid extraction (SFE) 657–8
 superoxide dismutase (SOD) 1043
 SWASV, *see* square wave anodic stripping voltammetry
 sweeteners 735
 Syrah, *see* Shiraz
- TAA, *see* total antioxidant activity
 takju 213, 214, 216
Tamon-in Diary 19
 tandem mass spectrometry 830–1
 tannins 307–8, 1045
 analytical methods 791, 800, 821, 834
 and astringency 921–2
 as ‘antinutrients’ 987
 as fining agents 349
 in Scotch whisky 492–3
 tartaric acid 803, 894
 tartrates 37
 taste 919–22
 taste buds 919–21
 taverns 18
 TCA, *see* 2,4,6-trichloroanisole
 TCA cycle, *see* tricarboxylic acid cycle
 tchapalo 223–4
 TDN, *see* 1,1,6-trimethyl-1,2-dihydronaphthalene
- TEAC, *see* Trolox equivalent antioxidant capacity
 tea liqueurs 624
 Tej 432
 temperature 362–3
 Tempranillo 302
 Tennessee whiskey 521
 Tentura 623
 tequila 567–70
 categories of 568
 determining authenticity 569–70, 638, 788, 825, 842
 nutrient content of 957
 terpenes 286, 368
 in gin 539–40
 terpenoids 1095
 analytical methods 727, 750, 838
 in gin 539–41
 tertiary aromas 367–70
 Tetrapak containers 1090
 thallium 820
 tharra 531
 thaumatin-like proteins 741
 thermal desorption 713
 thermal methods 907
 thermometers 35
 thermospray flame furnace atomic absorption spectrometry (TS-FF-AAS) 819–20, 821
 thermovinification 317
 thiamine (vitamin B1) 978, 1017
 thin layer chromatography (TLC) 706–8
 thiocyanate method 812–13
 thujone 442, 571, 1096–7
 Tia Maria 624
 TIC, *see* total ion chromatogram
 Tinta Barocca 303
 tintometers 36
 tirage 331–3
 titration procedures 896–9
 TLC, *see* thin layer chromatography
 TOCSY, *see* total correlation spectroscopy
 Tokay wines 50, 615
 top fermentation 163–7
 top pressure beer 190, 192
 total anthocyanin index 893
 total antioxidant activity (TAA) 1051–2
 total correlation spectroscopy (TOCSY) 769–70, 772, 773, 774, 779, 780
 total ion chromatogram (TIC) 748
 total phenolic content (TPC) 799, 893
 correlation with total antioxidant activity (TAA) 1051
 total quality management (TQM) 634
 tourne 111

- toxic compounds 942–3, 957
TPC, *see* total phenolic content
TQM, *see* total quality management
 trace elements 982
see also functional elements
 Traditional Method (*Méthode Traditionnelle*) 324–38
 transfer process 342
 Trappiste beers 196
 tricarboxylic acid cycle (TCA cycle) 84–5, 996–7, 1039
 2,4,6-trichloroanisole (TCA) 120, 300, 339, 1088–9
 determination of 672, 824
 trichlorofluoromethane, *see* freon 11
 1,1,2-trichloro-1,2,2-trifluoroethane, *see* freon 113
 trichothecenes 1103
 trihalomethanes 1088
 1,1,6-trimethyl-1,2-dihydronaphthalene (TDN) 779
 Trolox® equivalent antioxidant capacity (TEAC) 811–12
 TS-FF-AAS, *see* thermospray flame furnace atomic
 absorption spectrometry
 tsikoudia 598
 tsipouro 570, 598
 Tswett, Michel Semenovich 37, 709
 turbidity 117
 Twister 680
 tyramine 888, 1098–10
- UAE, *see* ultrasonic assisted extraction
 ultrafiltration 353
 ultrasonic assisted extraction (UAE) 657
 umqombothi 224–5
 Unico 623
 United Distillers 34
 untypical ageing *see* atypical ageing
 urea 804, 894
 urethane, *see* ethyl carbamate (EC)
 uric acid 972, 999
 Utopia beers 198
 UV-visible spectroscopy 793–814
- Van der Hum 619
 VDN, *see* vins doux naturels
 Velcorin (dimethyl dicarbonate) 129
 veraison 276
 Veranaccio di Oristano 394
 Vermouth 436–44
 bittering agents 442–3
 botanical ingredients 439–43
 flavor compounds 440–2
 history of 436–7
 origin of name 439
 phenolic compounds in 442–3
- production areas 437–8
 production methods 438–9
 vibration, effect on wine 364–5
 Vilanova, Arnáu de 616
 Villeneuve, Arnaud de 574
 vin clair 330
 vin de cuvée 328
 vin de réserve 330
 Vinho Verde 340
 Vin Jaune 394
 vins de liqueur 383, 414–15
 vins doux naturels (VDN) 409–13
 vins doux naturels style wines 413–14
 Viognier 270–1
 viscometers 905
 viscosity measurements 905–6
 visible-near IR (Vis-NIR) 789
 Vis-NIR, *see* visible-near IR
 vitamins 977–81
 A 981
 B 978–80
 C 980–1; *see also* ascorbic acid
 fat-soluble 981
 typical content in wine and beers 977
 water-soluble 978–81
- viticulture
 biodynamic 56–7, 371–2
 environmentally friendly 371–2
 history of 13, 14, 16, 26, 32
 precision 372–3
 vitisins 404, 776, 797
Vitis vinifera sativum 13
Vitis vinifera sylvestris 13
 vodka 22, 541–3, 957
 volatile acidity 115, 902
 volatile compounds, analysis of 647–91
 voltammetric methods 863–8
 cyclic voltammetry 864
 linear sweep voltammetry 863, 864
 polarography 866–8
 stripping voltammetry 865–6
 volumetric methods 35, 896–900
 vomitoxin, *see* deoxynivalenol (DON)
 Voyant Chai Cream 625
- Wasser 609
 water
 analysis of 669
 distribution in body 965–6
 for beer production 145–6, 953
 for Scotch whisky production 478–9

- water (*Continued*)
 intake recommendations 964
 nutritional value 963–6
- Wernicke–Korsakoff syndrome 1017
- wheat 475–8
 wheat beer 206–7
wheatgrass (Triticum aestivum) 1067
- whirlpool tanks 154
- whiskey 28, 515–33
 American 519–27
 Bourbon 28, 520–7
 corn 528
 differentiated from whisky 23, 469
 Irish 516–9
 nutrient content of 956
 regulations 515
 rye 527–8
 Tennessee 521, 522
see also Scotch whisky; whisky
- whisky 528–33
 Canadian 519, 528–9
 differentiated from whiskey 23, 469
 English 532–3
 history of 22–3
 Indian 531–2
 Japanese 529–31
 nutrient content of 956
 origin of word 23, 469
 production in continental Europe 533
 regulations 515
 rye 528
 Welsh 532–3
see also Scotch whisky; whiskey
- white wine 267–300
 acidity adjustments 290–2
 analyses 279–81
 antioxidant properties 1053
 atypical ageing (ATA) 369–70
 blending 298
 bottling 298–300
 chaptalization 290
 chemical composition of grapes 272–6
 clarification 289
 color changes 366–7
 crushing process 282–3
 destemming process 282–3
 fermentation 292–7
 filtration 297–8
 fining 297–8
 grape varieties for 267–71
 harvesting procedures 280–1
- malolactic fermentation 297
 must and juice protection 284–5
 nutrient content 952
 physical composition of grapes 271–2
 prefermentation treatments 288–9
 pressing process 286–8
 removal of reductive odors 298
 skin contact 285, 1053
 stages in development of grapes 276–8
 tertiary aromas in 368–70
 use of enzymes 285–6
 yeast strains for 293
- widget 30, 186
 ‘wild’ yeasts 32, 66, 67, 75–6
- Wilhelm of Bavaria, Duke 19, 636
- Windisch–Kolbach units 898
- wine 266–7
 adulteration of 638–9
 ageing 354–71
 alcohol content 33
 alcohol terminology 86
 antioxidant ability assessment 812–13
 aroma compounds in 88–93
 aromatized 436–45
 biodynamic production 56–7
 carbonated 339–40
 clarification 21, 289, 343–54
 closures 20–1, 299–300, 365–6, 810
 color changes 366–7, 402–4
 color measurements 795–7
 containers for 20, 300, 364, 376–7
 country 419, 423, 429–31
 cru classification 27
 dealcoholization of 375–6
 definition 266, 419
 effects of malolactic fermentation on 104, 106–11
 filtration 350–4
 fining 345–6
 fortified 21–2, 383–414
 fruit 419–31
 hazes in 274, 343, 881–2
 health perception of 54
 honey, *see* mead
 improving through ageing 370, 918
 lactic spoilage 111, 117
 liqueur (vins de liqueur) 383, 414–15
 low alcohol 33, 375–6, 452–3
 maturation 321–2, 354–66
 new trends in production 371–7
 nutrient content 951–2
 organic 33, 56

- pH of 99
 phenolic compounds in 304–9
 phytochemicals in 989–90
 production areas 7–8
 production in UK 33–4, 50–1
 ‘ropey’ 106–7, 111
 rosé 323–4, 330, 367
 spoilage 111, 114–21
 tertiary aromas in 367–70
 testing in unopened bottles 37, 773, 789
 trends in consumption 32, 48–50
 use of lead as preservative 26
 yeasts 293, 313–14
see also red wine; sparkling wines; white wine; wine industry; winemaking
- wine grapes
 aroma compounds in 275–6
 berry monitoring 278
 chemical composition 272–6
 harvesting 280–2, 309–10
 phenolic compounds in 273–4
 physical composition 271–6
 ripeness criteria 272, 309
 stages of development 276–8
 sugar content 272–3, 279
see also grapevines
- wine industry
 in California 11
 new locations 50–1
- wine lactone 778
- winemaking
 definition 278
 history of 12–13, 16–17, 20–2, 26–7, 32–3
 principles of 278–9
see also wine
- wine presses 20, 32, 287–8
- worm tube condensers 489
- wormwood, *see* *Artemisia* spp.
- wort 13, 144
 aeration of 193
 boiling 148–56
 cooling 155
 specific gravity (SG) 158
- wuliangye 546
- XAD-2 666–7, 672
 xanthohumol 1097
- yagyongju 623
 yakju 213, 214
 YAN, *see* yeast-assimilable nitrogen
 yanghe daqu 544–6
 yeast-assimilable nitrogen (YAN) 74, 805
 ‘yeast back’ 163
 yeast lees 99–100
 in brandy production 577
 in Champagne maturation 333–4
 in white wine production 293, 296–7
 waste in Scotch whisky production 498
- yeasts 67–9
 film forming 119–20, 391–2
 flocculation 87, 157–8
 for beer production 68–9, 157–8
 for brandy production 576
 for cachaça production 564
 for cider/perry production 241, 247, 251
 for fruit wines 427–8
 for natural control of molds 372
 for production of low alcohol beers 449–50
 for wine production 293, 313–14
 genetically modified 58–9, 163, 375
 growth 77–80
 killer strains 68, 76
 nutritional requirements 73–5
 physiology and morphology 72–3
 pitching 159
 spoilage 117–21
 use of selected strains 67, 76–7
 volatile compounds production 92–3
 ‘wild’ 32, 66, 67, 75–6
see also yeast lees
- Yorkshire Square 165–7
- Zamora 623
 zinc 986, 1082, 954–5, 1084–5
 zivania 599, 600, 825
Zygosaccharomyces spp. 118