

Index

Note: Page numbers of article titles are in **boldface** type.

A

Accreditation, for toxicology testing, **525–542**

clinical laboratory, 526–532

CLIA certification, 526

CLIA-exempt, 526–527

inspection in, 532

nonwaived testing in, 527–532

personnel for, 530–532

proficiency testing in, 527–530

waived testing in, 527

forensic, 494–495, 532–540

American Board of Forensic Toxicology Laboratory Accreditation Program (ABFT) for, 534–536

American Society of Crime Laboratory Directors Laboratory Accreditation Board (ASCLD/LAB) program for, 536–537

CAP program for, 533–534

legal implications of, 533

Substance Abuse and Mental Health Services Administration (SAMHSA) National Laboratory Certification Program for, 537–540

Accuracy, of method, in forensic toxicology, 498–499

6-Acetylmorphine, immunoassay screen for, 440

ADRB2 gene polymorphisms, 511

Alanine aminotransferase, as alcohol biomarker, 394–396

Alcohol use disorders, **391–406**

acute effects of, 392

biomarkers for

alternate specimen types for, 400–402

direct, 396–400

indirect, 394–396

chronic effects of, 392

dependence in, 392–393

epidemiology of, 392

ethanol metabolism and, 393

hair testing for, 479, 481

neonatal exposure to, 461–462

oral fluid testing in, 472–474

pharmacogenomics in, 517

physiologic effects of, 392–393

teratogenic effects of, 393

tolerance in, 392–393

Aldehyde adducts, as alcohol biomarkers, 396–397

Alprazolam, abuse of, 367–371

- Alternative performance assessment, 529–530
- American Academy of Forensic Sciences, Toxicology Section of, 494
- American Board of Forensic Toxicology Laboratory Accreditation Program (ABFT), 534–536
- American Board of Forensic Toxicology Laboratory Accreditation Program (ASCLD/LAB) program, 536–537
- American Board of Toxicology, certification by, 495
- American Society of Crime Laboratory Directors Laboratory Accreditation Board (ASCLD/LAB) program, 536–537
- Amniotic fluid testing, for neonatal drug exposure, 454
- Amphetamine(s)
 - abuse of, 409
 - cross-reactivity of, 443–444
 - immunoassay screen for, 440
 - neonatal exposure to, 460–461
 - oral fluid testing for, 475–476
- Amphetamine/dextroamphetamine, abuse of, 371–373
- Analysis by the Substance Abuse and Mental Health Services Administration, 367
- Antibodies, acetaldehyde, as alcohol biomarkers, 396–397
- Anticonvulsants, monitoring of, 472
- Anxiolytics, abuse of, 367–371
- Aripiprazole, pharmacogenomics of, 510
- Arsenic testing, in oral fluids, 475–476
- Aspartate aminotransferase, as alcohol biomarker, 394–396
- Atomoxetine, pharmacogenomics of, 510
- Attention-deficit/hyperactivity disorder, drugs for, 371–373
- AutoGenomics INFINITI 2D6 Mutation Detection Kit, 514
- Automation
 - for hospital drug screen, 356–357
 - for urine drug testing, 431–432
- Autopsy examination. *See also* Forensic toxicology.
 - pharmacogenomics in, 517

B

- Barbiturates
 - abuse of, 367–371
 - immunoassay screen for, 440
- Bath salts, 408–409, **415–427**
 - case report on, 416–417
 - chemistry of, 417–419
 - laboratory analysis of, 421–425
 - metabolism of, 419–421
 - regulations on, 415–416
- Benzodiazepines
 - abuse of, 367–371
 - cross-reactivity of, 436, 443
 - elderly persons using, 412
 - immunoassay screen for, 440, 442
 - monitoring of, 472
 - oral fluid testing for, 475, 477

- 1-Benzylpiperazine, abuse of, 409
- Biomarkers, alcohol
 - alternate specimen types for, 400–402
 - direct, 396–400
 - indirect, 394–396
 - panels for, 395–396
- BioRad REMEDi system, 356–357
- Biosite Triage test device, 432
- Blood spots, dried, testing of, 484
- Brain disorders, in alcohol use, 392
- Breast milk, drug testing of, 482
- Breath testing, 483
- Buprenorphine
 - abuse of, 362–367, 411
 - immunoassay screen for, 440

C

- Cannabinoids, 410
 - immunoassay screen for, 441
 - neonatal exposure to, 457–459
 - oral fluid testing for, 475
- Carbohydrate-deficient transferrin, as alcohol biomarker, 394–396
- Cardiovascular disorders, in alcohol use, 392
- Carisoprodol, pharmacogenomics of, 510
- Cathinones, synthetic, 417–419. *See also* Bath salts.
- CEDIA (cloned enzyme donor immunoassays), for urine drug testing, 431
- Center for Medicare and Medicaid Services, accreditation by
 - inspection for, 532
 - proficiency testing for, 527–530
- Central nervous system depressants, abuse of, 367–371
- Cerebrospinal fluid testing, 483
- Certificate of registration, for laboratories, 532
- Certificate of waiver, CLIA, 527
- Chain of custody
 - in forensic toxicology, 495
 - in neonatal testing, 451
- Child Welfare Information Gateway, 452
- Citalopram, pharmacogenomics of, 510
- CLIA. *See* Clinical Laboratory Improvement Amendments of 1988 (CLIA).
- Clinical Laboratory Improvement Amendments of 1988 (CLIA), accreditation by, 526
 - exempt laboratories, 526–527
 - inspection for, 532
 - nonwaived testing, 527–532
 - personnel requirements for, 530–532
 - waived testing, 527
- Clinical toxicology, versus forensic toxicology, 494
- Clobazam, pharmacogenomics of, 510
- Clonazepam, abuse of, 367–371
- Cloned enzyme donor immunoassays, for urine drug testing, 431
- Cocaine
 - metabolites of, immunoassay screen for, 441
 - neonatal exposure to, 455–457

Codeine
 abuse of, 362–367
 neonatal exposure to, 459–460
 pharmacogenomics of, 510, 512–514
 therapeutic monitoring of, 379–390

Colostrum, drug testing of, 482

Communication, during postmortem investigations, 500

Confirmation testing
 for neonatal drug exposure, 455
 for urine immunoassays, 444
 oral fluid specimens for, 476

Cord blood and tissue, testing of, 481–482

Criminal investigations. *See* Forensic toxicology.

Cross-reactivity, in urine drug testing, 435–436, 442–444

Current Opioid Misuse Measure (COMM), 365

Cytochrome P450, polymorphisms of, 511–520

D

Death, conflicting causes of, in postmortem investigations, 502

Decomposed bodies, specimen collection in, 502–503

Deemed status, for laboratories, 532

Dementia, in alcohol use, 392

Dependence, on alcohol, 392–393

Detection window, for urine immunoassays, 444

Diagnosis, Intractability, Risk and Efficacy (DIRE), 366

Diazepam, abuse of, 367–371

Digoxin, monitoring of, 354

Documentation
 for accreditation, 529
 for forensic toxicology, 498

Dried blood spots, testing of, 484

Drug(s)
 new, information on, 497–498
 postmortem redistribution of, 501
 stability of, prompt analysis and, 497

Drug abuse, 355. *See also* Prescription drug abuse.
 hair testing for. *See* Hair testing.
 in pregnancy, 481–482
 newly-emerging, **407–414**
 elderly persons and, 412
 hallucinogens, 410
 incomprehensible occurrences of, 413
 Internet resources for, 412–413
 opiate-related, 410–411
 stimulants, 409
 veterinary, 411–412
 oral fluid testing for. *See* Oral fluid testing.
 withdrawal from, 462

Drug Abuse Prevention Plan, 381

Drug Abuse Warning Network, 511
 report of, 361
 statistics in, 379–381

Drug library, 356
 Drug swipe, for sweat, 483
 Drug-drug interactions, in forensic toxicology, 503–504
 Ductal lavage fluid, drug testing of, 482

E

Elderly persons, drug abuse in, 412
 Electronic medical records, for accreditation, 529
 Emergency toxicology
 guidelines for, 437
 oral fluid testing in, 473
 Enzyme immunoassays, for urine drug testing, 431
 Enzyme-multiplied immunoassay, 355, 431
 Eszopiclone, abuse of, 367–371
 Ethanol use disorders. *See* Alcohol use disorders.
 Ethyl glucuronide, as alcohol biomarker, 397–398, 401–402
 Ethyl sulfate, as alcohol biomarker, 397–398

F

Fatty acid ethyl esters
 as alcohol biomarkers, 399–402, 461–462, 482
 hair testing for, 479
 Fentanyl
 abuse of, 362–367
 immunoassay screen for, 441
 neonatal exposure to, 459–460
 Fetal alcohol syndrome, 393, 462, 482
 FINDbase, 520
 First assay, in forensic toxicology, 497
 Flunitrazepam, abuse of, 369
 Flurbiprofen, pharmacogenomics of, 510
 Forensic toxicology, **493–507**
 certification and accreditation for, 494–495, 532–540
 chain of custody in, 495
 drug chemistry and, 494
 drug-drug interactions in, 503–504
 hospital specimens in, 496–497
 matrices for, 496
 pharmacogenomics and, 504
 postmortem, 496, 500–504
 quality assurance in, 498–500
 services provided in, 495–496
 subdisciplines of, 493
 versus clinical toxicology, 494
 Forensic Toxicology Certification Board, 495

G

Gamma-hydroxybutyrate, oral fluid testing for, 475
 Gas chromatography
 for bath salts, 421–424
 for hair testing, 480
 Gastric content testing, 469

Genetic Testing Reference Material Coordination Program, 521
 Glucuronidation, polymorphisms of, 511
 Glutamytransferase, as alcohol biomarker, 394–396

H

Hair testing, 478–481
 alcohol biomarkers in, 400–401
 fatty acid ethyl esters in, 400
 historical context of, 478
 in neonates, 452–454
 physiology of, 478
 specimen collection for, 478
 Hallucinogens, 410
 Hemoglobin, acetaldehyde, as alcohol biomarker, 396–397
 Herbal incense, 408, 410
 Heroin, pharmacogenomics of, 512, 515
 Hospital drug screen, 355–358
 Hospital specimens, for forensic toxicology, 496–497
 Human Cytochrome P450 Allele Nomenclature Web Site, 517–519
 Hybrid mass spectrometry, 357
 Hydrocodone
 pharmacogenomics of, 512, 516
 therapeutic monitoring of, 379–390
 Hydromorphone
 abuse of, 362–367
 pharmacogenomics of, 512
 therapeutic monitoring of, 379–390
 Hypnotics, abuse of, 367–371

I

Iloperidone, pharmacogenomics of, 510
 Immunoassays
 for hospital drug screen, 356
 for pain management monitoring, 383–388
 for urine drug testing, **429–447**
 advantages of, 430
 algorithm for, 444
 automated, 431–432
 confirmation of, 444
 cutoffs for, 437–438
 false-positives and false-negatives of, 440–442
 implementation of, 435–439
 limitations of, 438–444
 menu for, 437–438
 point-of-care, 431–432, 438–439
 principles of, 430–432
 quantitative, 438
 reporting for, 438
 results reporting and interpretation, 444–445
 specimens for, 436–437

- testing location for, 438–439
- validation of, 433–435
- oral fluid specimens for, 476
- Immunoglobulin A, to acetaldehyde, as alcohol biomarker, 396–397
- Inspection, for accreditation, 532
- Insulin, abuse of, 413
- Internet resources, for drug abuse, 412–413
- Intoxication, ethanol, 392
- Ion traps, in mass spectrometry, 357

K

- K2 (hallucinogen), 410
- Kinetic interaction of microparticle in solution (KIMS) assay, for urine drug testing, 431
- Kratom, 408, 411
- Krypton (Kratom), 411

L

- Laboratory director, responsibilities of, 530–531
- Lamotrigine, monitoring of, 472
- Lateral flow immunochromatography, for urine drug testing, 431–432
- Lead testing, in oral fluids, 475
- Legal ecstasy, 408
- Legal issues. *See also* Forensic toxicology.
 - in forensic toxicology, 533
 - in neonatal drug testing, 450–452
- Levetiracetam, monitoring of, 472
- Liquid chromatography
 - for bath salts, 421–424
 - for hair testing, 480
 - for hospital drug screen, 357
 - new libraries for, 497
- Liver enzyme tests, for alcohol, 394–396
- Lorazepam, abuse of, 367–371
- Luminex xTag 2D6 Mutation Detection Kit, 514

M

- Mandatory Guidelines for Federal Workplace Drug Testing Programs, 494
- Mass spectrometry
 - for bath salts, 421–424
 - for hair testing, 480
 - for hospital drug screen, 357–358
 - for pain management monitoring, 386–388
 - new libraries for, 497
- Mean corpuscular volume, as alcohol biomarker, 395–396
- Measure of uncertainty, in forensic toxicology, 499–500
- Meconium, testing of, 400, 402, 453, 481–482
- Medical Waste Tracking Act of 1988, 528–529
- Mephentermine, abuse of, 408, 412
- Metal testing, in oral fluids, 475–476

Methadone

- abuse of, 362–367, 411
- immunoassay screen for, 441
- neonatal exposure to, 459–460

Methamphetamine

- cross-reactivity of, 443–444
- neonatal exposure to, 460–461

Methoxetamine, 408, 410

Methyl mercury, hair testing for, 479

4-Methylcathinone, in bath salts, 409

Methylenedioxy substitution, in bath salts, 418–421

3,4-Methylenedioxypyrovalerone, in bath salts, 409

Methylphenidate, abuse of, 371–373

Mitragynine, 411

Morphine

- abuse of, 362–367
- neonatal exposure to, 459–460
- pharmacogenomics of, 512, 515–516
- therapeutic monitoring of, 379–390

N

Nails, alcohol biomarkers in, 401

Narcotics. *See* Opiates.

National Academy of Clinical Biochemistry guidelines, for emergency drug testing, 437

National Institute on Drug Abuse, web site of, 413

National Prescription Drug Take-Back Events, 367

National Survey on Drug Use and Health survey, on central nervous system depressants, 369

Neonatal abstinence syndrome, 460

Neonatal drug testing, **449–466**

- alcohol, 461–462
- amphetamines, 460–461
- cannabinoids, 457–459
- cocaine, 455–457
- consent for, 451
- criteria for, 451
- hair specimens for, 481
- legal issues in, 450–452
- maternal substance abuse and, 450–451
- methods for, 455
- opiates, 459–460
- rationale for, 450
- specimens for, 452–455
- withdrawal management and, 462

New drugs, information on, in forensic toxicology, 497–498

New York State Department of Health, CLIA-exempt program of, 527

Nicotine

- hair testing for, 479
- oral fluid testing for, 474–475

Nonwaived testing, CLIA, 527–532

Nuclear magnetic resonance spectroscopy, 421–424

O

Occupational Safety and Health Administration, safety regulations of, 528

Opiates

- abuse of, 362–367
- cross-reactivity of, 436, 442–443
- immunoassay screen for, 441
- in chronic pain management, 379–390
- neonatal exposure to, 459–460
- oral fluid testing for, 474, 477
- pharmacogenomics of, 512–516
- therapeutic monitoring of, **379–390**

Opioid Risk Tool (ORT), 366

Oral fluid testing, 469–478

- advantages of, 469
- for amphetamines, 476
- for benzodiazepines, 477
- for drug abuse, 474–475
- for emergency situations, 473
- for metal exposure, 475
- for opiates, 477
- for pain management, 473
- for pharmacogenomic studies, 472–473
- for pharmacokinetic studies, 472
- for population surveys, 475–476
- for therapeutic drug monitoring, 471–472
- historical context of, 469
- interpretation of results of, 477–478
- maternal, for neonatal drug exposure, 454
- methods for, 476
- physiology of, 470
- plasma drug concentrations correlation with, 470
- purpose of, 471
- specimen collection for, 471

Overdose, suspected, in postmortem investigation, 502, 517

Oxcarbazepine, monitoring of, 472

Oxycodone

- abuse of, 362–367, 411
- immunoassay for, 442–443
- neonatal exposure to, 459–460
- pharmacogenomics of, 512, 516
- therapeutic monitoring of, 379–390

Oxymorphone

- abuse of, 362–367
- pharmacogenomics of, 512
- therapeutic monitoring of, 379–390

P

Pain Assessment and Documentation Tool (PADT), 366

Pain management

- pharmacogenomics in, 516–517
- toxicology testing for, **379–390**, 473

Personnel, for laboratory accreditation, 530–532

- Pharmacogenomics, **509–523**
 databases for, 517–520
 drug target polymorphisms in, 510–511
 drug-metabolizing enzyme polymorphisms in, 511
 drugs with biomarkers for, 510
 in autopsy examination, 517
 in forensic toxicology, 504
 in pain management, 516–517
 of alcohol ingestion, 517
 of opiates, 512–516
 quality assurance in, 521
 studies of, oral fluid testing for, 472–473
 terminology of, 509–510
- Pharmacokinetics, studies of, oral fluid testing for, 472
- PharmGkb database, 520
- Phencyclidine, hair testing for, 479
- Phenytoin, monitoring of, 354, 472
- Phosphatidylethanol, for alcohol biomarker, 398–399
- Piperazine derivatives, abuse of, 409
- Placenta testing, for neonatal drug exposure, 454
- Polymorphisms, in drug response genes. *See* Pharmacogenomics.
- Population surveys, oral fluid testing in, 475–476
- Postmortem investigations, 500–504
 communication during, 500
 drug dose determination in, 501–502
 drug overdose in, 502
 drug pharmacogenomics and, 504
 drug-drug interactions and, 503–504
 in conflicting causes of death, 502
 postmortem redistribution of drugs in, 501
 results interpretation in, 500–501
 signs of toxic pathology in, 501
 specimens for, 496, 502–503
 tolerance and loss of tolerance in, 502
- Precision, of method, in forensic toxicology, 499
- Pregnancy, drug abuse testing in, 481–482. *See also* Neonatal drug testing.
- Prescription drug abuse, **361–377**
 central nervous system depressants, 367–371
 opiates, 362–367
 statistics on, 361–362
 stimulants, 371–373
- Proficiency testing
 in clinical laboratories, 527–530
 in forensic toxicology, 498
- Propoxyphene, abuse of, 411
- Pyrrrolidine substitution, in bath salts, 419–421

Q

- Quadrupoles, in mass spectrometry, 357
- Quality assurance
 in accreditation, 529
 in forensic toxicology, 498–500
 in pharmacogenomic testing, 521

R

- Rave drugs, 409
- Recordkeeping, for accreditation, 529
- Recreational drugs. *See* Drug abuse.
- Reflex protocols, for urine drug testing, 438
- Regulations
 - for accreditation. *See* Accreditation.
 - for bath salts, 415–416
 - for opiate abuse control, 367
- Results and interpretation
 - of oral fluid testing, 477–478
 - of postmortem investigations, 500–501
 - of urine drug testing
 - for pain management, 386–387
 - immunoassays, 444–445
- Risperidone, pharmacogenomics of, 510
- Roche Amplichip P450 kit, for pharmacogenetic testing, 513–514

S

- Safety issues, in laboratory accreditation, 528–529
- Saliva testing. *See* Oral fluid testing.
- Salvia (herbal product), 408, 410–411
- SAMHSA (Substance Abuse and Mental Health Services Administration), 511, 537–540
- Screeener and Opioid Assessment for Patients in Pain-Revised (SOAPP-R), 365
- Screening Instrument for Substance Abuse Potential (SISAP), 366
- Sleep medicines, abuse of, 367–371
- Smoking
 - hair testing for, 479
 - nicotine testing and, 474–475
- Society of Forensic Toxicology, 494
- Society of Hair Testing, 481
- Specificity, of method
 - in forensic toxicology, 499
 - urine immunoassays, 439, 442
- Specimens, for toxicology testing, **467–492**
 - availability of, 468
 - based on reasons for testing, 468
 - breast milk, 482
 - breath, 483
 - colostrum, 482
 - cord blood and tissue, 481–482
 - dried blood spots, 484
 - ductal lavage fluid, 482
 - ease of collection of, 468
 - forensic, 496
 - gastric contents, 469
 - hair, 478–481
 - meconium, 481–482

- neonatal, 452–455
- oral fluids, 469–478
- sweat, 482–483
- urine, 436
- Spice (hallucinogen), 410
- Stimulants. *See also* Bath salts.
 - abuse of, 371–373, 409
- Substance Abuse and Mental Health Services Administration (SAMHSA), 511, 537–540
- Sweat, drug testing of, 482–483
- Sympathomimetic agents, cross-reactivity of, 443–444
- Synovial fluid testing, 483

T

- Tandem mass spectrometry, for pain management monitoring, 386–388
- Temazepam, abuse of, 367–371
- Teratogenic effects, of alcohol, 393
- Testosterone, hair testing for, 480
- Therapeutic drug monitoring, 354–355, 471–472
- Thin layer chromatography, for hospital drug screen, 356
- Time-of-flight mass spectrometry, for bath salts, 421–424
- Tolerance
 - in postmortem investigations, 502
 - of alcohol, 392–393
- Topiramate, monitoring of, 472
- Toxicology testing
 - accreditation for, 494–495, **525–542**
 - evolution of, 353–354
 - for alcohol. *See* Alcohol use disorders.
 - for bath salts, **415–427**
 - for drug abuse. *See* Drug abuse.
 - for pain management, **379–390**, 473, 516–517
 - for prescription drugs, **361–377**
 - for therapeutic drugs, 354–355
 - forensic. *See* Forensic toxicology.
 - hospital drug screen, 355–358
 - immunoassays for. *See* Immunoassays.
 - in alternative specimen matrices, **467–492**
 - in neonates, **449–466**, 481
 - overview of, **353–359**
 - pharmacogenomics and, 472–473, 504, **509–523**
- Tramadol
 - metabolite of, 411
 - pharmacogenomics of, 516
- Tranquilizers, abuse of, 367–371
- Transferrin, carbohydrate-deficient, as alcohol biomarker, 394–396

U

- Umbilical cord, alcohol biomarkers in, 402
- Uncertainty, measure of, in forensic toxicology, 499–500

Urine drug testing

- for alcohol biomarkers, 397–398
- for pain management, **379–390**
 - assays used in, 383–385
 - clinical considerations in, 387–388
 - results interpretation in, 386–387
 - role of, 382
 - testing menu for, 382–383
- immunoassays for, **429–447**
- in hospital drug screen, 355–358
- in neonates, 452–455
- maternal, for neonatal drug exposure, 454

V**Validation, of methods**

- for accreditation, 530
 - in forensic toxicology, 498–499
- Veterinary drugs, abuse of, 411–412**
-
- VKORC1 gene polymorphisms, 511**

W

- Waived testing, CLIA, 527
- Warfarin, resistance to, 511
- Washington State, CLIA-exempt program of, 526
- Waste disposal, safe, in laboratory accreditation, 528–529
- Withdrawal, from drugs of abuse, 462

X

- Xylazine, 408, 411–412

Z

- Zaleplon, abuse of, 367–371
- Z-drugs, abuse of, 367–371
- Zolpidem, abuse of, 367–371