BURLINGTON COUNTY BAR ASSOCIATION

Interpreting Your Client's Drug Lab Results: Were They Impaired?

DO LAB RESULTS MATTER IN A DUI-D?

YES

- *State v. Olenowski* DRE challenge–outcome will likely add significant weight to toxicology results in DUI-D cases

- Lab and Science v. DRE– When the lab results are not assailable due to accuracy or resources

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- Lab and Science v. DRE– When the lab results are not assailable due to accuracy or resources are limited

--BREAKING NEWS--

NEW JERSEY IS IN THE MIDDLE OF HISTORIC HEARINGS ON THE ADMISSIBILITY OF "DRE" OPINIONS

State v. Olenowski

WHY DREs?

STATE v. SMITH-- NJ SUPREMES 1971 & NJRE 701

ALCOHOL INTOXICATION FACTS *AND* OPINION –NO EXPERT NEEDED

STATE v. BEALOR—NJ SUPREMES 2005 & NJRE 702 (THE "NEED")

EXPERT TESTIMONY REMAINS THE PREFERRED METHOD OF PROOF OF MARIJUANA INTOXICATION

SPECIALIZED LAY WITNESS?

OTHER DRUGS—EXPERT NEEDED?

THE 12 STEP DRE EVALUATION

- BREATH ALCOHOL SCREENING
- DRE INTERVIEWS ARRESTING OFFICER
- PRELIMINARY EXAM & FIRST PULSE
- EYE EXAMS: TRACKING, EQUAL PUPIL SIZE, HGN, VGN, AND NON-CONVERGENCE
- DIVIDED ATTENTION TESTS: ROMBERG (BODY SWAY AND 10 SECOND INTERVAL CLOCK), WAT, OLS, FINGER-TO-NOSE
- VITAL SIGNS & SECOND PULSE
- DARK ROOM CHECKS OF PUPIL SIZE (WAIT 90 SECONDS), NASAL & ORAL CAVITY EXAM
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- OPINION OF EVALUATOR
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DRUG EVALUATION PROGRAM
3 STEP PROCESS

- Verify That The Suspect Is Impaired And That The BAC Is Not Consistent With The Degree Of Impairment
- Determine Whether The Impairment Is Drug Related *Or* Medically Related (Injury Or Illness)
- Use "Proven Diagnostic Procedures" To Determine The Category (Or Combinations) Of Drugs That Is/Are The Likely Cause Of Impairment

STATE v. OLENOWSKI
NJ Supreme Court

"Proven Diagnostic Procedures"

THE EXISTING FACTUAL RECORD IS INADEQUATE TO TEST THE VALIDITY OF DRE EVIDENCE

UNTIL SUCH A RECORD IS ESTABLISHED, THE COURT *SHOULD NOT ADDRESS* THE QUESTION OF THE ADMISSIBILITY OF THE DRE EVIDENCE PRESENTED IN THIS CASE UNDER NJRE 701 or 702

STATE v. OLENOWSKI
NJ Supreme Court

Judge Lisa is appointed as Special Master and will conduct:

"a plenary hearing to decide whether DRE evidence has achieved general acceptance within the relevant scientific community and therefore satisfies the reliability standard of NJRE 702"

NEW JERSEY

- NO *REPORTED* APPELLATE DIVISON CASE APPROVING USE OF DRE EVALUATIONS TO ASSESS DRIVING IMPAIRMENT

- *STATE v. REITER*: NJ App. Div. 2007 (UNREPORTED) – ADMISSIBLE TESTIMONY BUT…("trained and certified")

THREE APPROACHES #1

- Oregon and Washington have conducted scientific admissibility hearings (*State v. Baity* 2000)
- Limited hearings--held that "some" of the components of the DRE Program are scientific and admissible under those two states' standards
- Conditional admissibility: *every* step of the twelve step process must be completed *AND* the toxicology must be complete, admissible and corroborative

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THREE APPROACHES
#3

- The majority view of US state courts
- *Frye/Daubert* hearing is not required because DRE evidence does not meet the "new or novel" requirement that would trigger such a hearing
- "Common observations cloaked in scientific garb"
- DRE can testify because its merely recitation of observations any witness would make

THREE APPROACHES
#3

- UNDER MAJORITY APPROACH, THE DRE'S OPINION IS CONSIDERED A LAY OPINION *ONLY*

- THEREFORE CORROBORATIVE TOXICOLOGY BECOMES CRITICAL!

THREE APPROACHES
#3

- UNDER MAJORITY APPROACH, THE DRE'S OPINION IS CONSIDERED A LAY OPINION *ONLY*

- THEREFORE CORROBORATIVE TOXICOLOGY BECOMES CRITICAL!

CORROBORATIVE OR NECESSARY?

DRE MANUAL SAYS THAT THE TOXICOLOGY IS CORROBORATIVE—MORE DIFFICULT ARGUMENT NOW UNDER NEWER *I.A.C.P.* GUIDANCE

HOWEVER, IT IS PART OF THE 12 STEP DRE MATRIX THAT *MUST* BE COMPLETED IN ITS ENTIRETY

Debunking the "corroborative" DRE findings with a 2 step approach

- *Step #1*: Establish what observations not corroborative of impairment in your unique client's behavior
- *Step #2*: Evaluate the quantitative presence of drugs found in defendant's toxicology
- *Limits to Defense*: Need Rx and reasonable facts

THE 12 STEP DRE EVALUATION

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THE 12 STEP DRE EVALUATION

ONE MOMENT IN TIME

- BREATH ALCOHOL SCREENING
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STEP #1
Establish What's Not Corroborative

- DRE doesn't know your client except one moment in time
- Behavioral pattern may not comport with drug impairment, but your client's individual circumstances
- Buttressed by treating physician who has been monitoring prescriptions and adjusting to allow functionality

EXPLORE "OTHER FACTORS"

- General appearance
- Cognitive level
- Neuro conditions
- Driving explanation
- Condition for which Rx given
- Subject's normal baseline
- Pre-existing conditions
- Age
- Weight
- Historical dosage Hx
- Dosage Hx that day
- Dexterity

THINGS THAT MIMIC DRUG CLASS

- *CNS DEPRESSANTS*: FATIGUE, HEAD INJURY, DIABETIC REACTION, HYPOTENSION, INNER EAR DISORDER, SEVERE DEPRESSION

- *CNS STIMULANTS*: HYPERACTIVITY, NERVOUSNESS, STRESS, HYPERTENSION, FEAR

- *HALLUCINOGENS*: HIGH FEVER, MENTAL ILLNESS

THINGS THAT MIMIC DRUG CLASS

- *DISSOCIATIVE ANESTHETIC*: MENTAL ILLNESS
- *NARCOTIC ANALGESIC*: FATIGUE, RECENT HEAD INJURY, DIABETIC REACTION, HYPOTENSION, SEVERE DEPRESSION
- *INHALANTS*: SEVERE HEAD INJURY, INNER EAR DISORDERS
- *CANNABIS*: ATTENTION DEFICIT DISORDER, "THE MUNCHIES"

STEP #2
DO THE TOXICOLOGY RESULTS SUPPORT A CONCLUSION INCONSISTENT WITH THE DRE OPINION?

WHEN IT WORKS BEST

1. THERAPEUTIC RANGE RESULT
2. UNDER DOCTOR CARE WITH Rx– THE REAL DEAL IN "PROVEN DIAGNOSTIC PROCEDURES"

SOME TERMS

- *Tolerance*–Acquired ability of the body after regular exposure to a drug to react less acutely to drug's effects

- *Half-life*–the amount of time for the human body to eliminate ½ of an administered dose of drug

- *Therapeutic levels*– concentration of drug and/or its active metabolite(s) present in the blood (serum or plasma) following therapeutically effective dosage in humans–at steady state

Pharmacokinetics (PK) Dosage Route

- PK is what the body does to drugs once ingested
- Stomach to veins to liver
- Liver will metabolize a portion depending on solubility
- Remainder back out into circulation and eventually back to liver
- Cycle continues until body metabolizes the drug and completely eliminates it

THERAPEUTIC DOSE
&
THERAPEUTIC RANGE

HOW DO WE DETERMINE?

Winek, Baselt, and Schulz/Schmoldt charts

Therapeutic, toxic, and lethal dosage for thousands of drugs

THERAPEUTIC DOSE & THERAPEUTIC RANGE

WINEK

https://www.abmdi.org/documents/winek_tox_data_2001.pdf

BESELT, RANDALL

Disposition of Toxic Drugs and Chemicals in Man

SCHULZ & SCHMOLDT

Therapeutic and toxic blood concentrations of more than 800 drugs and other xenobiotics

Pharmazie 58, 447–474 (2003)

DRUGSCAN®
GREAT CHEMISTRY™

February 10, 2020

[redacted] Police Department
[redacted]

TOXICOLOGY REPORT IN THE CASE OF:

[redacted]
DrugScan Accession No: [redacted]

EXAMINATION: Under the Influence of Alcohol, other Volatile Intoxicants and/or Common Controlled Substances

SPECIMENS: Received in a Sirchie Kit –
Two (2) sealed and labeled GRAY top tubes BLOOD –
on January 28, 2020 from [redacted]

FINDINGS[1]:

1. ALPRAZOLAM (Xanax) –

   69 nanograms Alprazolam/mL BLOOD

   Benzodiazepines were detected using a qualitative screening assay and Alprazolam was identified, confirmed and measured by liquid chromatography/mass spectrometry/mass spectrometry.

2. COCAINE --

   43 nanograms Cocaine/mL BLOOD
   425 nanograms Benzoylecgonine (Cocaine metabolite)/mL BLOOD

   Cocaine related products were detected using a qualitative screening assay and cocaine and cocaine metabolite (benzoylecgonine) were identified, confirmed and measured by liquid chromatography/mass spectrometry/mass spectrometry.

3. CANNABINOIDS (Marijuana) --

   3 nanograms Delta-9-THC (Marijuana constituent)/mL BLOOD
   19 nanograms 9-Carboxy-THC (Marijuana metabolite)/mL BLOOD

   Cannabinoids were detected by immunochemical assay and were identified, confirmed and measured by gas chromatography/mass spectrometry.

[1]Positive chromatographic data attached.

200 Precision Road, Suite 200 Horsham, PA 19044-1227 Phone: 215-674-9310 Fax: 215-675-5353
www.drugscan.com

DRUGSCAN®
GREAT CHEMIST

[redacted] Police Department

February 10, 2020

TOXICOLOGY REPORT IN THE CASE OF:

[redacted]
DrugScan Accessio[redacted]

EXAMINATION: Under the Influenc[redacted] Alcohol, other Volatile Intoxicants and/or Co[redacted] Substances

SPECIMENS: Received in [redacted]chle Kit –
Tw[redacted]2) sealed and labeled GRAY top tubes BLOOD –
on Januar[redacted]8, 2020 from [redacted]

FINDINGS[1]:

1. ALPRAZOLAM (Xanax) –

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19 ng THC-COOH/mL BLOOD

[redacted]

4. OXYCODONE (e.g., OxyContin) –

   31 nanograms Oxycodone/mL BLOOD

   Opiates were detected using a qualitative screening assay and Oxycodone was identified, confirmed and measured by liquid chromatography/mass spectrometry/mass spectrometry.

COMMENTS:

1. Alprazolam (Xanax) is a potent benzodiazepine controlled substance used in the treatment of anxiety. Following a single 1 mg oral dose peak plasma levels ranged from 10 to 20 nanograms/mL. Following chronic therapy (0.5 mg t.i.d.) steady state levels averaged 20 nanograms/mL. Patients clinically prescribed this potent depressant medication are warned accordingly, especially concerning motor vehicle operation.

   Alprazolam is commonly abused as a "street" drug in combination with other controlled substances.

2. Following typical use of cocaine, blood plasma levels generally reach several tens to several hundreds of nanograms/mL, declining over a period of the next several hours to undetectable amounts.

   Cocaine is a Schedule II listed excitant stimulant, capable of causing restlessness, excitement, talkativeness, and occasionally, aggressive or manic behavior.

   Cocaine breaks down into the controlled (Scheduled II) non-active substance Benzoylecgonine, and can continue to do so even after the specimen has been collected.

3. Delta-9-THC (tetrahydrocannabinol) is the principal psychoactive ingredient of marijuana - a Schedule I controlled substance. It is metabolized to the non-psychoactive compound Delta-9-Carboxy-THC. Following absorption by smoking, plasma levels of THC rise very rapidly, and peak levels are attained in a few minutes. These plasma levels then decline rapidly during the next hour, then more slowly over the next several hours, becoming undetectable (around 0.5 ng/mL) usually about 6 hours later. Delta-9-Carboxy-THC levels rise more slowly, and persist longer, being detectable for approximately 24 hours.

4. Oxycodone is a controlled (Scheduled II) narcotic analgesic, often compounded with other ingredients such as non-narcotic analgesics. Its indications, uses, and effects are similar to morphine. Following typical clinical intake, plasma levels range from 10 to 40 nanograms/mL.

CONCLUSION:

At and around the time the blood was drawn, it is reasonably scientifically certain that this individual --

- was a recent user of – ALPRAZOLAM, COCAINE, MARIJUANA and OXYCODONE- in pharmacologically significant dosage amounts;
- was under the impairing psychoactive effects of Alprazolam, Cocaine, Marijuana and Oxycodone; and
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19 ng THC-COOH/mL BLOOD

Alprazolam

- Benzodiazepine family; CNS depressant

Winek

DRUG	Therapeutic or Normal		Toxic		Lethal	
	mg%	ug/ml	mg%	ug/ml	mg%	ug/ml
Alprazolam	0.025 - 0.102		***	***	0.0122 - 0.039	0.122 - 0.39

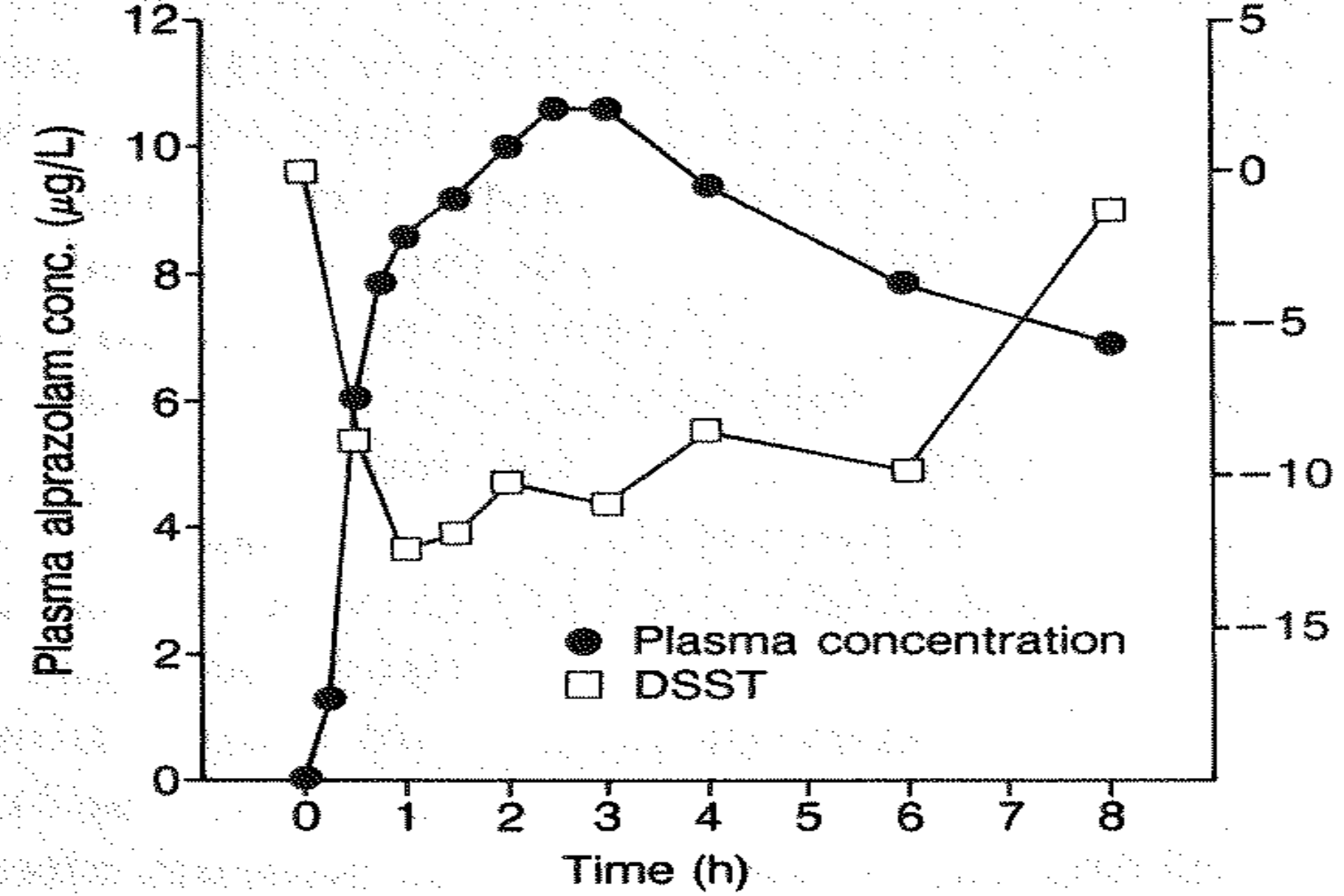
Schulz & Schmoldt

	0.005–0.05	0.1–0.4

- Micrograms/L (ug) same as ng/L but labs (like DrugScan) usually report in ng/mL
- Convert by x1000
- **Winek** therapeutic range Alprazolam is **25-102** ng/mL
- **Schulz** therapeutic range is **5-50** ng/mL
- Client results: 69 ng/mL

Analysis

- Therapeutic range close to lab results
- Other human variables involved
- Alprazolam comes in 0.5mg, 1.0mg, and 2.0mg doses
- Very possible for multi-dose per day individual to have 69 ng plasma levels without impairing effect based on tolerance and other factors including "steady state" of drug


Plasma alprazolam conc. (μg/L)
12
10
8
6
4
2
0
5
0
−5
−10
−15
0
1
2
3
4
5
6
7
8
Time (h)
Plasma concentration
DSST

PK Variables on Blood Plasma Levels of Drug

- Age
- Weight (lipid solubility)
- Gender
- Ethnicity
- Renal or liver disease
- Cigarette smoking
- Menstrual cycle
- Alcoholism

Cocaine

- Reported results are 43 ng/mL BLOOD

Therapeutic Ranges

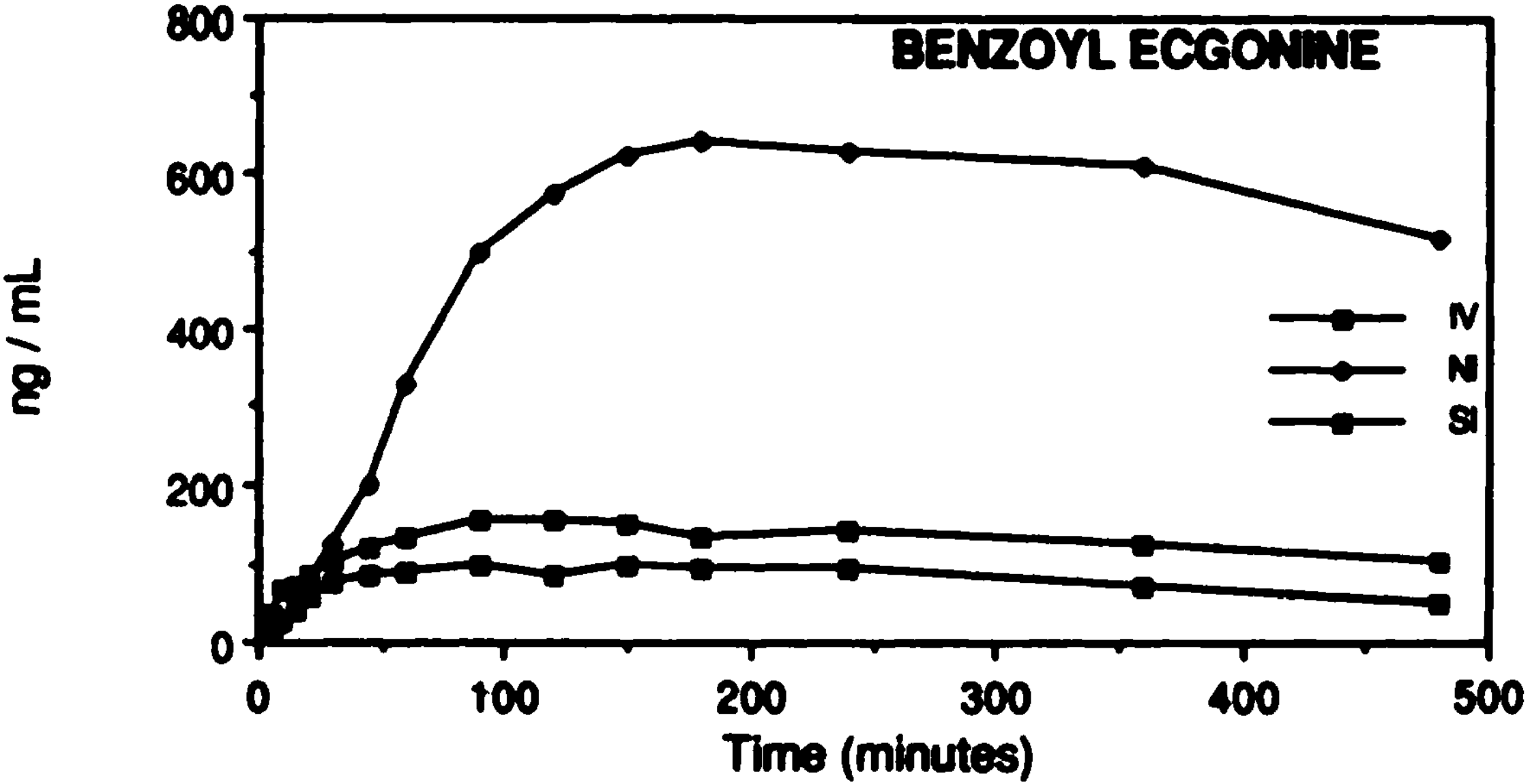
- Winek: 50–93 ng/mL
- Schulz/Schmoldt: 50–300 ng/mL

- *Lesson*: wide range of authority on "therapeutic range"

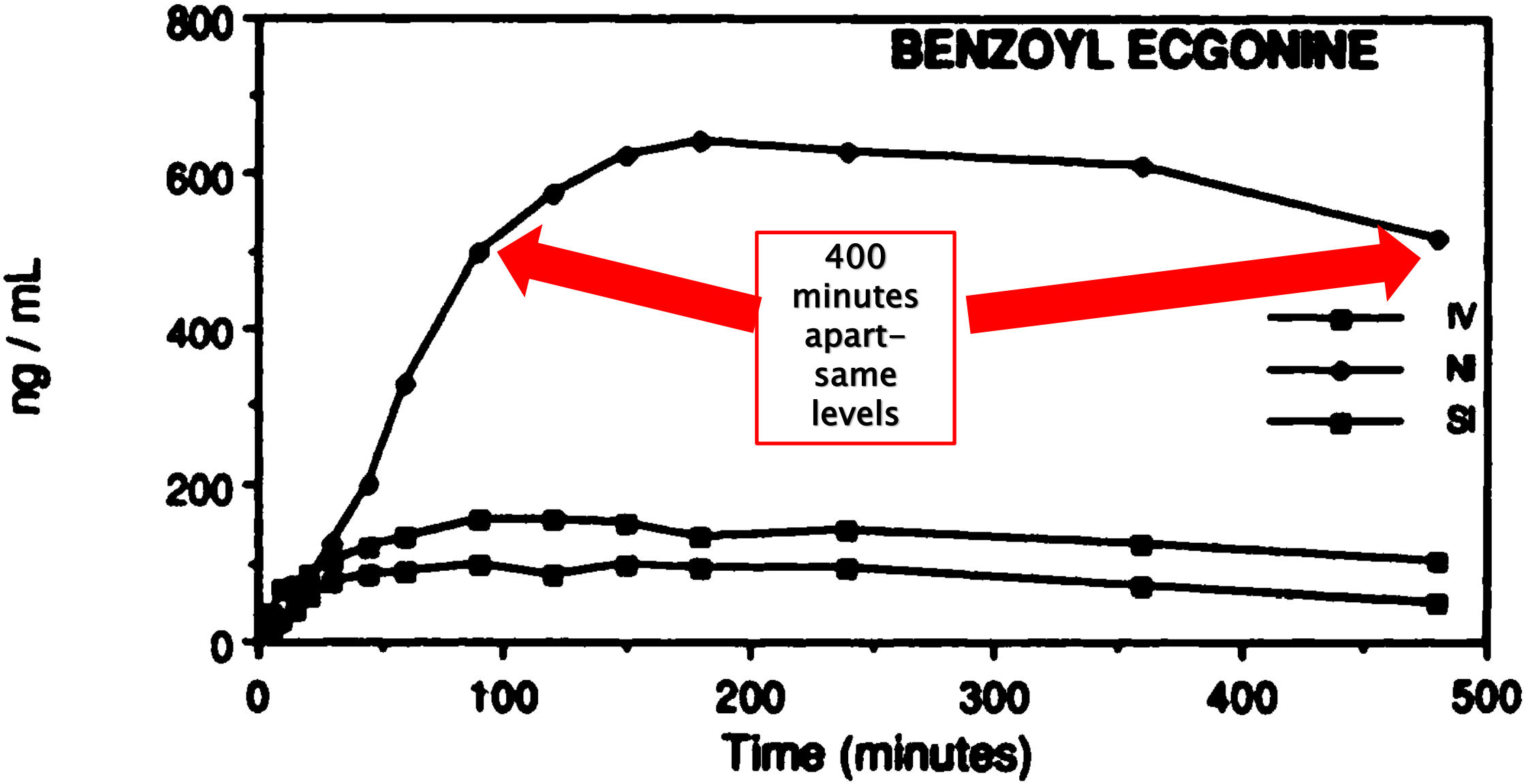
What about Benzoylecgonine?

- 1st pass metabolite of parent drug cocaine
- Non-psychoactive compound
- Presence in lab results is significant only to determine time of dosage vis-à-vis cocaine results (needed)

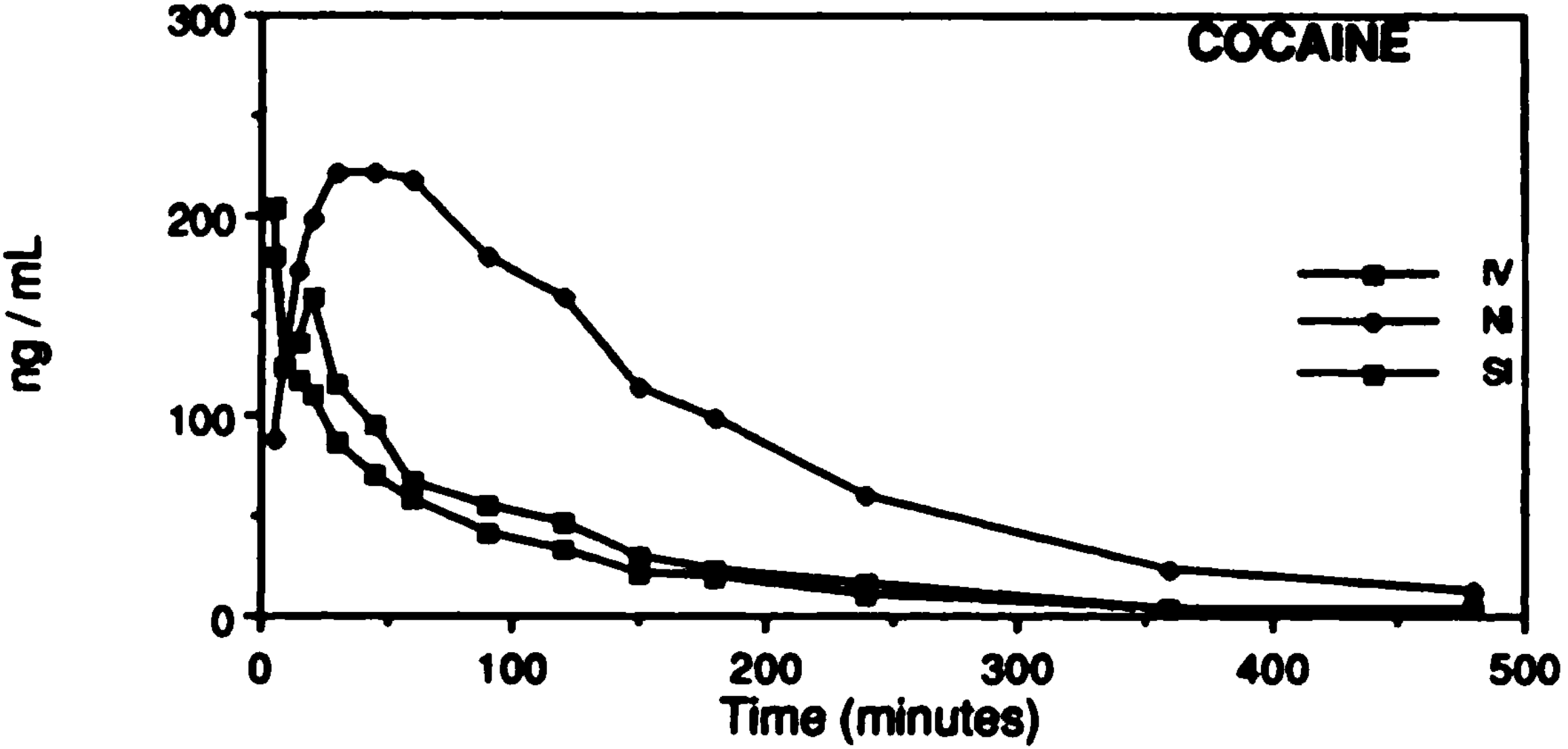
Cocaine & Benzoylecgonine



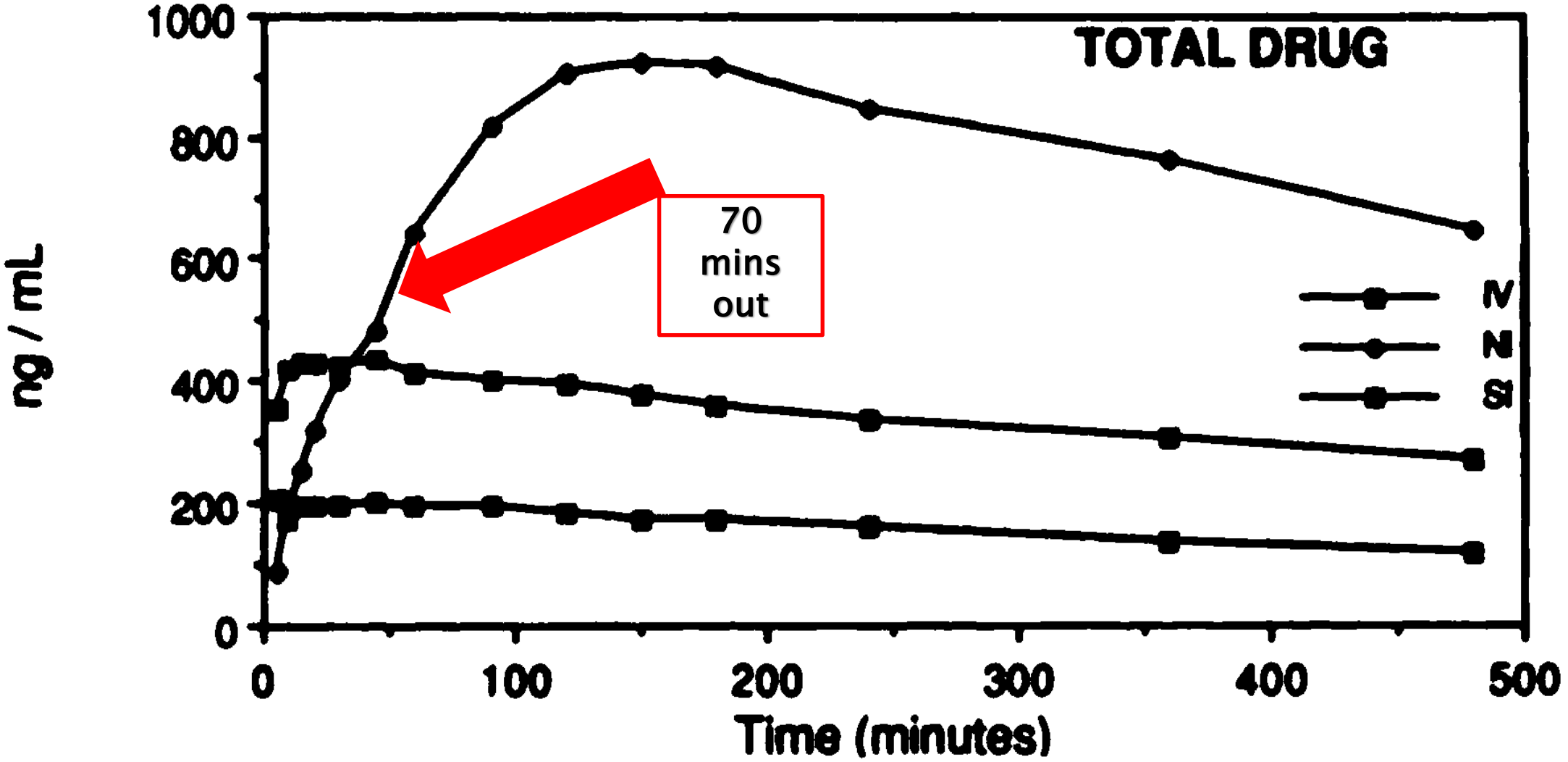
Cocaine & Benzoylecgonine (500 ng/mL)



Cocaine & Benzoylecgonine (50 ng/mL)



Cocaine & Benzoylecgonine (500 ng + 50 ng/mL)



•. Mar-Apr 1989;17(2):153-9.

- **Source**: *Cocaine disposition in humans after intravenous injection, nasal insufflation (snorting), or smoking, AR Jeffcoat, et al; Drug Metab Dispos; Mar-Apr 1989;17(2):153-9*

Oxycodone

Narcotic analgesic

- Our results: 31 ng/mL

- *Winek*: 10–100 ng/mL
- *Schulz*: 20–50 ng/mL

- Well within therapeutic range with either source

[redacted]

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   Alprazolam is commonly abused as a "street" drug in combination with other controlled substances.

2. Following typical use of cocaine, blood plasma levels generally reach several tens to several hundreds of nanograms/mL, declining over a period of the next several hours to undetectable amounts.

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   Cocaine breaks down into the controlled (Scheduled II) non-active substance Benzoylecgonine, and can continue to do so even after the specimen has been collected.

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- was unfit to operate a motor vehicle safely on the highway.

[redacted]

4. OXYCODONE (e.g., OxyContin) –

31 nanograms Oxycodone/mL BLOOD

31 ng Oxycodone/mL BLOOD

Opiates were detected using a qualitative screening assay and Oxycodone was identified, confirmed and measured by liquid chromatography/mass spectrometry/mass spectrometry.

COMMENTS:

"FOLLOWING TYPICAL CLINICAL INTAKE, PLASMA LEVELS RANGE FROM 10-40 ng/mL"

…nt benzodiazepine controlled substance used in the treatment of anxiety. …ose peak plasma levels ranged from 10 to 20 nanograms/mL. Following …) steady state levels averaged 20 nanograms/mL. Patients clinically …ssant medication are warned accordingly, especially concerning motor …

…d as a "street" drug in combination with other controlled substances.

…e, blood plasma levels generally reach several tens to several hundreds of …a period of the next several hours to undetectable amounts.

Cocaine is … listed excitant stimulant, capable of causing restlessness, excitement, talkativeness, …nally, aggressive or manic behavior.

Cocaine breaks do… …he controlled (Scheduled II) non-active substance Benzoylecgonine, and can continue to do so ev… …the specimen has been collected.

3. Delta-9-THC (tetrahydro… …inol) is the principal psychoactive ingredient of marijuana - a Schedule I controlled substance. It … …etabolized to the non-psychoactive compound Delta-9-Carboxy-THC. Following absorption by smo… …plasma levels of THC rise very rapidly, and peak levels are attained in a few minutes. These plasma le… …hen decline rapidly during the next hour, then more slowly over the next several hours, becoming u… …ectable (around 0.5 ng/mL) usually about 6 hours later. Delta-9-Carboxy-THC levels rise more slowl… …nd persist longer, being detectable for approximately 24 hours.

4. Oxycodone is a controlled (Scheduled …) narcotic analgesic often compounded with other ingredients such as non-narcotic analgesics. Its indications, uses, and effects are similar to morphine. Following typical clinical intake, plasma levels range from 10 to 40 nanograms/mL.

CONCLUSION:

At and around the time the blood was drawn, it is reasonably scientifically certain that this individual --

- was a recent user of – ALPRAZOLAM, COCAINE, MARIJUANA and OXYCODONE- in pharmacologically significant dosage amounts;
- was under the impairing psychoactive effects of Alprazolam, Cocaine, Marijuana and Oxycodone; and
- was unfit to operate a motor vehicle safely on the highway.

Marijuana

- Possible Compounds

- *Delta-9 THC*-parent drug; psychoactive properties

- *Delta-9-hydroxy-THC* (THC-OH)—1st pass metabolite; psychoactive properties

- *THC-COOH* (carboxy THC)- inactive metabolite; no psychoactive effect whatsoever

Marijuana

Our results

- 3 ng/mL delta-9 THC BLOOD (parent drug)
- 19 ng/mL delta-9-THC-COOH (carboxy)
- *Source: Marilyn Huestis studies*: 13.1 ng/mL THC (*blood)* is about equivalent to 0.08% BAC EtOH

- *R Hartman, et al. Cannabis Effects on Driving Lateral Control with and without Alcohol. Drug & Alcohol Depend Sept 2015 pgs 25-37*
- *Hartman RL, Brown TL, Milavetz G, Spurgin A, Gorelick DA, Gaffney G, & Huestis MA (2015b). Controlled cannabis vaporizer administration: blood and plasma cannabinoids with and without alcohol. Clinical Chemistry.61:850-869*

Table 1

Relationship Between Time After Smoking, Average Blood THC Concentration (ng/mL), and Percentage of Subjects Considered Impaired Under Standardized Field Sobriety Tests (SFSTs)[a]

	Time 1 (0–5 min)		Time 2 (50–55 min)		Time 3 (100–105 min)	
Dose	Blood THC	% impaired	Blood THC	% impaired	Blood THC	% impaired
Placebo	0	2.5	0	7.5	0	5
1.74% THC	55.5	23	6.8	23	3.7	15
2.93% THC	70.6	46	6.2	41	3.2	28

THC, Δ^9-tetrahydrocannabinol.

[a]Time 1, 0 min after smoking for blood sampling and 5 min for SFSTs; Time 2, 50 min after smoking for blood sampling and 55 min for SFSTs; Time 3, 100 min after smoking for blood sampling and 105 min for SFSTs.

WHAT IF THERAPEUTIC RANGE CHARTS DO NOT GIVE YOU WHAT YOU NEED?

PLAN “B”

THERAPEUTIC DOSE
&
THERAPEUTIC RANGE

One size fits all?

THERAPEUTIC DOSE
&
THERAPEUTIC RANGE

WINEK CRITICISM

- Information obtained post-mortem to determine OD cause of death, not driving impairment
- Behavioral tests relied upon are not sourced (Schulz/Schmoldt does source)
- Matrix not reported—and it matters. Whole blood, serum blood, urine???

THERAPEUTIC DOSE
&
THERAPEUTIC RANGE

Winek's and Baselt's charts

- *Self disclosed caveats in data*: The values can be affected by dose, route of administration, absorption differences, age

- The values can be affected by gender, tolerance, method of analysis, pathological or disease state, postmortem redistribution, etc.

THERAPEUTIC DOSE
&
THERAPEUTIC RANGE

- There is no therapeutic drug level in urine for *ANY* drug
- There is *NO* correlation of urine concentration to pharmacologic effect
- There is no agreed upon therapeutic drug level for oxycodone in the blood

SCIENCE STUFF

- At lower doses, marijuana "does not affect simple motor skills" (*Source*: DRE Student Manual)

- Alprazolam can actually increase pulse and irritability (contrary to DRE Student Manual which indicates it lowers pulse)(*Source*: Drugs.com)

SCIENCE STUFF

- Benzoylecgonine (inactive metabolite) detected for 2-3 days after cocaine abstinence v. 12 hours or less for cocaine; (*Source*: J. Anal. Tox., Jufer, RA, 2000)

- THC-COOH (inactive metabolite) can be detected in urine more than 30 days after cannabis abstinence; non-psychoactive metabolite (*Source:* multiple Huestis studies)

- Virtually impossible to scientifically associate a degree of drug influence based on the blood plasma level of amphetamine (*Source*: Jour. Society for the Study of Addiction, 2007, Jones, A.)

THAT'S IT FOR NOW
Stay Safe

REVIEW

Center for Drug Information and Pharmacy Practice[1], ABDA – Federal Union of German Associations of Pharmacists, Berlin, and Institute of Legal Medicine[2], University of Hamburg, Germany

Therapeutic and toxic blood concentrations of more than 800 drugs and other xenobiotics

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In order to assess the significance of drug levels measured in clinical and forensic toxicology as well as for Therapeutic Drug Monitoring (TDM) it is essential that good collections of data are readily available. For more than 800 substances, therapeutic ('normal') and, if data was available, toxic, and fatal plasma concentrations as well as elimination half-lives were compiled in a table. The compilation includes data for hypnotics, benzodiazepines, neuroleptics, antidepressants, sedatives, analgesics, anti-inflammatory agents (e.g., NSAIDs), antihistamines, antiepileptics, betaadrenergic antagonists, antibiotics (penicillins, cephalosporins, aminoglycosides, gyrase inhibitors), diuretics, calcium-channel blockers, cardiac glycosides, antiarrhythmics, antiasthmatics, ACE-inhibitors, opiate agonists, and local anesthetics, among others. In addition, toxicologically relevant xenobiotics were listed. Data have been abstracted from published information, both compilations and primary sources and have been completed with data collected in our own forensic and clinical toxicology laboratories. Wherever possible, ranges for therapeutic plasma concentrations are expressed as trough concentration at steady state. The half-life values given for each drug are chosen to represent the terminal log-linear phase at most. It is the purpose to rapidly assess the significance of drug levels for the therapeutic monitoring of patients, and to facilitate the diagnostic and clinical assessment in case of intoxications.

1. Introduction

It has been common for several years that plasma concentrations of drugs having a narrow therapeutic range have to be measured. This accounts, among others, for antiepileptics, cardiac glycosides, aminoglycosides, antiarrhythmics, theophylline, immunosuppressants, and few cytostatics. It is indicated to draw blood samples for the following reasons: if doses are high and borderline, if signs of overdosage occur although the dose is within normal range (e.g. genetic polymorphism), if there is no effect although the dose is correct or if non-compliance can be expected. In general, plasma concentrations at steady state are retrievable from dosage and pharmacokinetic data. However, sufficient pharmacokinetic data are often not available. Therefore, it makes sense to offer a compilation of therapeutic and toxic plasma concentration ranges for quick information. A list [469] published in 1997 has been completely revised and updated. In particular, data for drugs recently introduced to the market have been added. Reviews, compilations of other authors [e.g., 28, 99, 100, 109, 111, 112, 114, 155, 268, 269, 340, 354, 395, 423, 426–429, 495, 528, 534] and publications concerning individual drugs/xenobiotics and case reports have been used to set up the database. Experience gained over several years from working in the clinical and forensic toxicological field also contributed to the following list.

2. Selection and criteria for evaluation

The substances have been selected by clinical and toxicological aspects, by frequency of prescribing and other matters in the area of internal intensive care medicine as well as clinical and forensic toxicology. There is an increase in determining antibiotic concentrations using analytical and chemical methods and there are special cases which are closely monitored although therapeutic concentrations depend on the susceptibility of the microorganisms and tissue concentrations are often more reliable.

Screening the data in daily practice, it became obvious that for many well known drugs there is only insufficient pharmacokinetic data available. However, for current substances little documented data is published about intoxications and their plasma/blood concentrations.

In general, therapeutic plasma concentration ranges or concentrations found after therapeutic dosing refer to trough levels at steady state. Inter-individual deviation is high. Therefore, any data listed can only be taken as orientation.

Often, it is not possible to find the threshold between the therapeutic and toxic concentration for the specific patient. This is the case if tolerance develops and if drug interactions or additional diseases are involved. In order to keep the overall context clear, we preferred not to go into further details.

Data about fatal plasma concentrations consciously orient on life threatening or lethal intoxications who occurred at low plasma concentrations so that actual and potential dangers in clinical cases are not being underestimated. Many intoxicated patients survived even with significantly higher concentrations. It is also difficult to relate the concentrations to the clinical picture because the interval between intake of the drug and drawing a blood sample is generally unknown. In any case, it is more relevant to have the correct concentration measured rather than how much drug has been – presumingly – taken. Statements about case histories are often not reliable. And often, it is not known how much drug has been absorbed after intake of charcoal, due to vomiting and/or irrigation of the stomach.

Elimination half-lives are statistically more reliable than data gathered in case of intoxications. Yet even with this data, substantial deviation can be expected. In addition, most pharmacokinetic parameters are retrieved from healthy subjects after application of relatively low doses. The data indicated generally deals with the terminal elimination half-life which most of the time is higher than the half-life of the intended biological effect (see annotations).

Table: Therapeutic ('normal'), toxic, and comatose-fatal blood-plasma/serum concentrations (µg/mL) in man

Substance	Blood-plasma/serum concentration (µg/ml)			$t_{½}$ (h)	Ref.
	Therapeutic ('normal')	toxic (from)	comatose-fatal (from)		
Acamprosate	appr. 0.37–0.65[231]			13–20[232]	[155, 444]
Acebutolol	0.2–2 (0.5–1.255)		15–20	3–11	[440, 466]
N-Acetylacebutolol[1]	1–2.5		90–150	9–14	[466]
Acecainide	see (N-Acetyl-) Procainamide				
Acecarbromal(um)	10–20 (sum)	25–30		?	
Acemetacin	see Indomet(h)acin				
Acenocoumarol	0.03–0.1[197]	0.1–0.15		3–11	[155, 340, 527, 528]
Acetaldehyde	0–30	100–125			[527, 528]
Acetaminophen	see Paracetamol				
Acetazolamide	(4–)10–20[267]	25–30		2–6	[155, 468, 469, 528]
Acetohexamide	20–70	500		1.3	[423]
Acetone	(2–)5–20	100–400; 2000[8]	550	(6–)8–31	[528, 545, 573]
Acetonitrile			0.77		[528]
Acetyldigoxin[3]	0.0005–0.0008	0.0025–0.003	0.005	40–70	[420, 516]
Acetylsalicylic acid (ASS, ASA)[2]	20–200	300–350	(400–)500	3–20[37]	[77, 207, 234, 329, 334, 409, 548]
Acitretin	appr. 0.01–0.05[112]			2–4[6]	[291, 488]
Acyclovir	(0.4–0.63) 0.5–1.5[203]			2–5[83]	[148, 155, 358, 476, 527]
Adipiodone-Meglumine	850–1200			0.5	[489]
Äthanol	see Ethanol			–[139]	
Ajmaline	(0.1–) 0.53–2.21 (?)		5.5[8]	1.3–1.6, 5–6	[155, 426]
Albendazole	0.5–1.5[92]			8–9[92]	[104, 333, 348, 572]
Albuterol	see Salbutamol				
Alcuronium	0.3–3			3.3±1.3	
Aldrin	–0.0015	0.0035			[528]
Alendronate	<0.005			–[6]	[411]
Alfentanil	0.03–0.6[4]			0.6–2.3[96]	[299, 327, 462, 541]
Alfuzosine	0.003–0.06			3–9	[423]
Alimemazine (Trimeprazine)	0.05–0.4	0.5	1–3.2	8	[114, 428]
Alizapride	0.1–2			2–3	[423]
Allobarbital	2–5	10	20	40–48	
Allopurinol	2–19			0.5–3	[133, 528]
Alphaprodine	0.87–1			1.6–2.6	[528]
Alprazolam	0.005–0.05 (–0.08)[65]	0.1–0.4	[252]	6–20	[114, 155, 272, 286, 293, 301, 341]
Alprenolol[48]	0.025–0.14	1–2	40–48	2–7	[466]
Aluminium	<0.005[234]	0.05–0.15	4.4[8]	appr. 0.5	[133, 371, 429, 528]
Amantadine	0.2–0.6 (–1)	1; 2.4[8]	21[8]	9–15	
Amfebutamone	see Bupropion				
Amikacin[76]	10–25	30		2–3	[71]
Aminobenzoic acid	300–600	600			[429]
Aminoglutethimide	0.5–25			13.3 ± 2.65	[133, 155, 528]

Table (continued)

Substance	Blood-plasma/serum concentration (μg/ml)			$t_{½}$ (h)	Ref.
	Therapeutic ('normal')	toxic (from)	comatose-fatal (from)		
Aminophenazone	10–20			appr. 2–4	[423]
4-Aminopyridine (Fampridine)	0.025–0.075	0.14[8]; 0.2		3–3.5	[503, 527, 528]
5-Aminosalicylic acid (5-AS, 5-ASA)	see Mesalazine				
Amiodarone[261]	(0.5–) 1–2 (–2.5)	2.5–3		30–120[6]	[54, 133, 155, 449]
Amisulpride	–0.4			12–18	[423]
Amitriptyline[7, 48]	0.05–0.3	0.5–0.6	1.5–2	30–50	[45, 57, 114, 121, 151, 181, 304, 305, 345, 415]
Amlodipine	0.005–0.015 (0.003–0.011)	0.088[8, 165]	0.1–0.2[8, 166]	34–50	[268, 275, 492]
Ammonia	0.5–1.7				[528]
Amobarbital	1–5	5–6	10	15–30	
Amodiaquine	–0.05[270]			–[270]	[133, 510]
Amoxapine	0.18–0.6[151]	3	5	8	[340]
Amoxicillin	0.5–1 (5–15)			1–2	[423]
Amphetamine	0.02–0.1	0.2	0.5–1	4–8	[201, 429]
Amphotericin B	(0.1–) 0.2–3	(3–) 5–10		24–48[110]	[79, 192, 310]
Ampicillin	0.02–2 (2–20)			1	[71]
Amrinone	1–2(–4)			3–12	[155, 200, 269]
Amsacrine	0.1–0.5 (0.15–5.5)			5–7	
Anileridine	<0.5		0.9[8]	?	[528]
Aniline	appr. –1 (urine)		6		[133, 528]
Antimony	–0.01	0.2			[133]
Antipyrine	see Phenazone				
Apomorphine	0.002–0.02[204]			appr. 0.75	[155, 527]
Aprindine[48]	1–2	2–3		13–50	
Aprobarbital	4–20	30–40	50	14–34	
Arsenic	0.002–0.07	0.05–0.25	9–15		[133, 528]
Articaine	<1.5–2 (?)			0.3 (–1)	[379]
Ascorbic acid (Vitamin C)	4–15	?		–[6]	[39, 155, 241, 321, 546]
Astemizole	0.002–0.05[43]	14[8]		appr. 20[6, 42, 43]	[28, 155, 487a]
Atenolol	0.1–1 (–2)[77]	2–3	27[8]	4–14[9]	[155, 426, 466, 504]
Atovaquone	13.9 ± 6.9 (>15)			2–3[6]	[490]
Atracurium(besylate)	0.1–0.5 (–5)			appr. 0.5	
Atropine	0.002–0.025[155]	0.03–0.1	0.2	2–6.5, 13–38	[429, 524, 528]
Azapropazone (Apazone)	40–80			8–24	
Azathioprine[10]	–2			1–4[11]	
Azelastine	0.002–0.003(–0.01)			22–25	[423]
Azithromycin	appr. 0.04–1			50–60 (2–4[6])	[17, 312, 402, 436, 470]
Aztreonam	1–10 (50–250)			1.5–2	[528]
Baclofen	0.08–0.4(–0.6)	1.1–3.5	6–9.6	6.8 ± 0.7	[28, 340, 528]
Bambuterol	see Terbutaline			10	
Barbital	2–20	20–50	50	57–120	
Barium	–0.001				[133]
Bendrofluazide	0.05–0.1			appr. 3	[426]
Benoxaprofen	–50			19–39	[133, 155]
Benperidol	appr. –0.002			4–8	[423]
Benzbromarone	2–10			2–4	
Benzene	–0.0002[271]		0.95		[528]
Benzphetamine	0.025–0.5	0.5	14[8]	?	[28, 528]
Benztropine	0.01–0.18	0.05	0.2–0.7	?	[423, 528]
Benzyl alcohol	?	18[8, 194]		–[195]	[155, 210, 314]
Benzylpenicillin	1.2–12			1	[71, 489]
Bepridil	0.6–2.5			33–42	[178]
Beryllium	–0.0003				[133]

Table (continued)

Substance	Blood-plasma/serum concentration (μg/ml)			$t_{½}$ (h)	Ref.
	Therapeutic ('normal')	toxic (from)	comatose-fatal (from)		
Betacarotene	4–6[196]	?			[155, 168]
Betaxolol	0.005–0.05		36[8]	14–22	[28, 34a, 466]
Bethanidine	0.02–0.5			9–10	[155, 528]
Bevantolol	0.2–2			2	[423]
Bezafibrate	–15			2	[133, 155]
Bicalutamide	1.5–17.5 (–25)[163]			(3–) 7–10[6]	[325]
Biperiden	0.05–0.1		0.25[8]	18–24	[114]
Bismut(h)	<0.05 (–0.1)	0.05–0.1		–[6]	
Bisoprolol	0.01–0.1			10–12	[466]
Bopindolol	0.001–0.015[54]			4–8[54]	[466]
Borate	0–7	20	200		[429]
Boron	0.8–6	20–50	50–150		[528]
Brallobarbital (Brallobarbitone)	4–8	8–10	15	20–40	
Bretylium	0.8–2.4			6–11	[155]
Brodifacoum		0.02	0.03–0.17; acute: 3.9[8]	20–60[6]	[391a, 528]
Bromadiolon		0.02			[528]
Bromazepam	(0.05–) 0.08–0.2	0.3–0.4	(1–) 2	8–22	[272]
Bromide	10–50	500–1500; 3000[8, 242]	2000	12–13[6]	[186, 213, 497, 528]
Bromisoval	10–20	30–40		appr. 4[28, 105]	
Bromoxynil		20			[133]
Bromperidol	0.001–0.02			20–36	
Brompheniramine	0.005–0.015	0.2[8]		2–10 (–20)	[423]
Brotizolam	0.001–0.02		10[8]	4–10	[28, 443a]
Budipine	appr. 0.1–0.3			30	[423]
Buflomedil	appr. 0.2–0.5 (–1.0)	15–25	25–50; 275[8]	2–4	[426, 528]
Bunitrolol	0.001–0.015			2–6	[466]
Bupivacaine	(0.25–) 0.5–1.5 (–2)	2–4		0.5–3	[155, 202, 260, 300]
Bupranolol	–[44]			2–4	[466]
Buprenorphine	0.0005–0.005 (–0.01)	0.2 (?)	1.1[8]; 4–13	3–5	[28, 133, 155, 520a, 544]
Bupropion (Amfebutamone)	0.01–0.02; 0.05–0.1[152]	1.2[246]	7.3	10–20	[28, 132, 148a, 214, 222, 287, 305, 412, 509]
Buspirone	0.001–0.004 (–0.01)			2–3	[528]
Butabarbital	see Secbutabarbital				
Butalbital	1–5	10–15	15–30	30–40	
Butanone	–10	500			[133]
Butaperazine	0.02–0.3(–0.7)			12	[423]
Butorphanol	0.0006–0.002			4–9	[423]
Butriptyline	0.07–0.15	0.4–0.5		?	[423]
Cadmium	–0.0065	0.015–0.05			[133, 528]
Caffeine (Coffein)	(2–) 4–10	15–20	180	2–10	[28, 82, 155, 350, 433]
Calcifediol	0.01–0.05				[429]
Camazepam	0.1–0.6	2		20–24	[272]
Camphor		0.3–0.4	1.7	?	[423]
Candesartan	0.08–0.18			5–7	[423]
Canrenone	see Spironolactone				
Captopril	0.05–0.5 (–1)	5–6	60	1–2	[4, 268, 426]
Carazolol[23]	–0.015			9	[466]
Carbamazepine[12]	2–8 (4–12)	10	20	12–60 (7–35)[140]	[60, 81, 114, 124, 145, 258, 311]
Carbaryl		5	6		[28, 114a]
Carbenoxolone	appr. 5–30			8–20	[429]
Carbimazole[95]	0.5–3.4[95]			3–5[95]	
Carbinoxamine	appr. 0.02–0.04			appr. 10–15	[502]

Table (continued)

Substance	Blood-plasma/serum concentration (μg/ml)			$t_{½}$ (h)	Ref.
	Therapeutic ('normal')	toxic (from)	comatose-fatal (from)		
Carboc(h)romene	0.8–2.4			0.2–1.5	
Carbon monoxide	–[200]	25–30%	50–60%		[155, 527, 528]
Carbon tetrachloride	–0.07	7.1[8, 269] ; 20–50	100–200		[458, 528]
Carboplatin	max. 10–25			2.5–6[106]	
Carbromal(um)[13]	2–10	15–20	40	7–15	
Carisoprodol	10–30	40	50[8, 104]	8	[114, 528]
β-Carotine	see Betacarotene				
Carteolol	0.01–0.1			3–7	[466]
Carvedilol	appr. 0.02–0.15 (–0.3)			6–10	[155, 269]
Cefaclor	13–35 (i.v. –900)			0.5–1	[155, 528]
Cefalexin	–65			1–1.5	[489]
Cefaloridine	20–80			1.5	[489]
Cefamandole	1–5 (10–40–150)			0.5–1.2	[489, 528]
Cefazolin	–150			1.5–2	[71, 489]
Cefoperazone	–250			1–2 (–5)	[88]
Cefotaxime	0.5–2 (10–50, i.v. –225)			1–1.5	[71]
Cefotetan	65–90			3.5	[489]
Cefotiam	–150[71]			0.7–1.5 (–2)	[464, 489]
Cefoxitin	–150			0.7–1	[489]
Cefsulodin	20–100			1.6–1.9	[155, 528]
Ceftazidime	20–40 (50–200)			1.6–2	[155, 528]
Ceftibuten	appr. 3–20			2–4	
Ceftizoxime	40–160			6–9	[489]
Ceftriaxone	15–75			6.5–8.5	[71]
Cefuroxime	0.5–1 (–180) ; 7–59[243]			1.1–1.3	[155, 315, 392, 527, 528]
Celiprolol	0.05–0.5			3–6	
Cephalothin (Cefalotin)	–30			0.5–0.6	[155, 489]
Cerivastatin	0.002–0.04			1.5–3	[423]
Cetirizine	appr. 0.02–0.3	2–5		7–9	[28, 423]
Chinidine	see Quinidine				
Chinine	see Quinine				
Chloralhydrate[14]	1.5–15	40–50	60–100	8–30	
Chlorambucil	0.15–0.3 (–1.0)			1.5–3	[423]
Chloramphenicol	5–10 (–15)[59]	25		2–6	[277, 528]
Chlordane	–0.001	0.0025	1–7		[133, 528]
Chlordecone		0.5			[133]
Chlordiazepoxide[15]	0.4–3	3.5–10	20	6–24	[18, 28, 114, 528]
Chlormethiazole	see Clomethiazole				
Chlormezanone	(3–) 5–9 (–14)	appr. 20	18[8]; 53[8]	20–30	[104, 114, 279]
Chlorobutanol	?	75			[429]
Chloroform	20–50	70–250	390		[528]
Chlorophacinone		0.1			[133]
Chloroquine	0.02–0.5	1	3	dose-dependent[6]	[83, 114, 234]
Chlorothiazide	appr. 6			0.5–2	[155, 528]
Chlorphen(ir)amine	0.003–0.017		1.1[8]	15–25	[28, 133, 155, 528]
Chlorpromazine[66]	0.03–0.1 (–0.5)	1–2	3–4	10–30	[114, 155, 245, 346]
Chlorpropamide	30–150	200–750		25–60	[429, 528]
Chlorprothixene	0.02–0.2	0.4	0.8	10–30	
Chlorpyrifos		0.2		27	[28, 133]
Chlortalidone	0.15–0.3 (–1.4)	appr. 2		44–48 (35–70)	
Chlortetracycline	1–5 (–10)	30		5–6	[340, 468, 469]
Chromium	–0.00035		32[8]		[28, 133]
Cibenzoline	0.2–0.4 (–0.9)	(0.5–) 1		7–8[83]	[155, 537]
Cicletanine	appr. 1–2			5–23	[155, 423]
Ciclosporine	see Cyclosporine				
Cidofovir	appr. 7–43			2.5	[155, 423]

Table (continued)

Substance	Blood-plasma/serum concentration (µg/ml)			$t_{½}$ (h)	Ref.
	Therapeutic ('normal')	toxic (from)	comatose-fatal (from)		
Cilazapril(−)at	0.003–0.09			30–50	[423]
Cimetidine	0.25–3 (0.75–4)	30–50	110[8]	1.5–4	[172, 477]
Cinoxacin	appr. 15			1.5–4	
Ciprofloxacin	2.5–4	11.5[8]		3–6	[80, 93, 454, 494]
Cisaprid	0.04–0.08			6–12	[423]
Citalopram	appr. 0.01–0.2 (– 0.1?)		5–6[160]	appr. 33[170]	[173, 188, 242, 380, 386–388, 423]
Cladribine	appr. 0.006			0.1–0.2 (6.4–19.7)	[36, 248, 261]
Clarithromycin	appr. 0.2–2			3–7[217]	[17, 53, 423, 436, 437, 463]
Clemastine	appr. 0.001–0.002 (?)			appr. 8	[56, 423]
Clenbuterol	0.0003–0.0006	0.003[8]		34–35	[28]
Clindamycin	appr. 0.5			2–3	
Clobazam[17]	0.1–0.4			10–32	[272, 274]
Clobutinol	appr. 0.05–0.2			23–34	[155, 423]
Clofibrate	50–250			10–18	
Clomethiazole (Chlormethiazole)	0.7–2	(2.8–) 4–15	50	3–7	[155, 273, 340, 468, 532]
Clomipramine [48, 85]	(0.02–) 0.09–0.25 (–0.4)[226]	0.4–0.6	1–2	20–26[86]	[20, 87, 131, 151, 156, 285, 305]
Clonazepam	(0.004–) 0.01–0.08[150]	0.1		20–60	[60, 286, 431]
Clonidine	0.001–0.002 (–0.004)	0.025–0.05 (0.009[8])	0.23[8]	8–25	[28, 127, 367, 417]
Clopenthixol	0.002–0.015	0.05–0.1		15–25	[423, 528]
Clorazepate[15]	see Nordazepam			1–2	[145]
Clotiazepam	0.1–0.7			3–15	
Cloxacillin	5–30 (–85)			0.5–1 (0.3–2)	
Clozapine[136]	(0.1–) 0.3–0.6 (>0.35 ?)	0.6–1 (9.5[8])	1.2[8]; 2[8] ; 5.2[8]	6–14	[85, 134, 174, 326, 571]
Cobalt	0.0001–0.0022				[133, 528]
Cocaine	0.05–0.3	0.5–1	4	0.5–1[18]	[28, 65, 133, 397, 468, 469, 528]
Codeine[48]	0.03–0.25	0.5–1	1.8	3–4	[155, 484]
Coffein(e)	see Caffeine				
Colchicine	0.0003–0.0025	0.005	0.024[8]	11–32[143]	[29, 435, 527]
Colistin	1–5			2–5	
Copper	0.6–1.5	2	5		[133, 429]
Cotrimoxazole	see Sulfamethoxazole and Trimethoprim				
Cresol (Methylphenols)		appr. 50	120		[133, 528]
Cromolyn (Cromoglycate)	appr. –0.01			1–1.5	[133, 155]
Cyanide	–[177]	0.5	1–3	appr. 19[184]	[30, 155, 179, 220, 434, 446, 497, 505]
Cyclizine	0.1–0.25	0.75–1	15	24	[133, 528]
Cyclobarbital	2–6	10	20	8–17	
Cyclobenzaprine	appr. 0.003–0.04	0.4		18 (9–40)[253]	[133, 528, 565]
Cyclohexane	–0.4				[133]
Cyclophosphamide	10–25			4–8 (1.3–16)	[155, 423]
Cyclopropane	80–180				[133, 528]
Cyclosporine A (CsA)	<0.1–0.15–0.25	0.3–0.4[16]		10–27[169]	[116, 219, 306, 307, 377, 520]
Cyproheptadine	appr. –0.05		0.47[8]	appr. 16	[28, 133, 155]
Cyproterone acetate	?			30–40	[325]
Cytarabine	0.05–0.5			0.1–0.2 (1.9–2.5)	[248, 340]
2,4-D	see 2,4-Dichloro-phenoxyacetic acid				
Danazol	appr. –0.2			4.5	[133, 155]
Dantrolene	(0.1–) 0.4–1.5 (–3)			4–12	[155, 340, 534]

Table (continued)

Substance	Blood-plasma/serum concentration (μg/ml)			$t_{½}$ (h)	Ref.
	Therapeutic ('normal')	toxic (from)	comatose-fatal (from)		
Dapsone[48]	0.5–2	10	18[8]	25–31	[280, 406]
Deferoxamine (Desferrioxamine)	3–15			4–6	
Demoxepam	0.5–0.74	1	2.7		[429]
Desipramine[48, 69]	0.01–0.5 (0.12–0.25)	0.5–1	3	15–25[70]	[57, 69, 304, 305, 356]
Desmethyldiazepam	see Nordazepam			40–80	[272]
Dexamethasone	appr. 0.05–0.265[247]			2.5–9.5	[155, 432]
Dexfenfluramine	appr. 0.03–0.06	0.15–0.25		appr. 18	[429, 528]
Dextromethorphan[48]	0.01–0.04	0.1	3	2–4	[195, 427]
Dextromoramide	0.075–0.15	0.2	0.9	0.1–1.5 (?)	[28, 266a, 423, 526, 528]
Dextropropoxyphene	0.05–0.3 (–0.5)	1	1–2	10–30	[234]
3,4-Diaminopyridin (DAP)	<0.04[213]	0.1 (?)		0.3–2[214]	[37]
Diazepam[19]	0.2–2 (–2.5)	3–5		24–48	[65, 107, 155, 272, 431, 468, 469, 521]
Diazinon		0.05–0.1 (–0.5)			[133, 528]
Diazoxide	10–20 (–50)	50 (–100)		20–36 (–48)	[155, 268, 426, 527, 528]
Dibenzepine	0.025–0.15 (0.1–0.5)	3	18	3.5–5	[133, 528]
Dichloromethane		200	280		[133]
2,4-Dichlorophenoxyacetic acid (2,4-D)	–	appr. 100	200; 392[8]; 720[8]	appr. 18[182]	[155, 528]
Dichlorvos			29	0.16	[28]
Diclofenac	0.5–3	50; 60[8]		1–2	[92, 133, 141, 142]
Dicoumarol	8–30	50–70		1–4[6]	[133, 528]
Dicyclomine (Dicycloverin)	–0.1	appr. 0.2	0.5	1.8–2	[133, 423]
Didanosine	appr. 1–30 μmol/l			1	[66, 67, 155, 358]
Dieldrin	–0.0015	0.15–0.3			[28, 133, 528]
Diethylcarbamazine	>0.8–1.0			4–15	[47]
Diethylpentenamide (Valdetamide)	2–10	20	45	6–7	
Diethylpropion	0.003–0.007 (–0.2)	2	5.4[8]	4–8[23]	[133, 155, 423, 528]
Difenacoum		0.5			[133]
Diflunisal	40–100 (–200)	300–500	600	5–12[83]	[133, 155, 340, 528, 556]
Digitoxin	0.01–0.025	0.03	0.04	140–200	[109, 171]
Digoxin	0.0005–0.0008 (–0.002)	0.0025–0.003	0.005	40–70	[108, 120, 217, 251, 357, 420, 516, 529, 550]
Dihydralazine	see Hydralazine				
Dihydrocodeine	0.03–0.25	0.5–1	2	3–4	[133, 469, 528]
Dihydroergotamine	0.001–0.01			7–9	[133, 155]
Diltiazem	0.03–0.13 (–0.25)[157]	0.8–1	2–6; 7[8]; 8[8]	2–6 (4–9)	[133, 155, 268, 528]
Dimenhydrinate	see Diphenhydramine				
Dimethadione	700–1000	1000		?	[133, 155, 528]
Dimethindene	0.01–0.05			appr. 6	[155, 423]
N,N-Dimethyltryptamine	0.001–0.1				[528]
4,6-Dinitro–2-methylphenol		40			[133]
Dinitro-o-cresol (DNOC)	1–5	30–60	75		[528]
Diphenhydramine	0.05–0.1 (–1)	1–2 (–4)	5–10	4–10, 20–60	[86, 235, 524, 528]
Diphenoxylate	appr. 0.01			2–3	
Dipipanone	appr. –0.05	0.2		?	[133]
Diprophylline	see Dyphylline				
Dipyridamole	0.1–1.5	4		11–13	[340, 468, 469]
Dipyrone	see Metamizole				
Diquat		0.1–0.4			[133, 528]
Disopyramide	2–7[78]	8		5–8	[133, 528]
Disulfiram	0.05–0.4	5	8	appr. 5–7	
Dixyrazine	appr. 0.3[249]		5.5[8]; 9.4[8]		[383]

Table (continued)

Substance	Blood-plasma/serum concentration (μg/ml)			$t_{½}$ (h)	Ref.
	Therapeutic ('normal')	toxic (from)	comatose-fatal (from)		
Domperidone	appr. 0.01–0.1			12–16	[24, 155, 208, 223, 343]
Donepezil[207]	appr. 0.03–0.075			70–100	[230, 438]
Dothiepin (Dosulepin)[20]	0.02–0.1	0.8	1	11–40	[265, 467]
Doxacurium	0.01–0.3			1–2[83]	
Doxapram	(1.5–) 2–5	9[268]		2.4–9.9	[22, 133, 155, 528]
Doxazosin	0.01–0.15			10–22	[269]
Doxepin[21]	0.01–0.2 (0.03–0.1)	0.5–1	2–4	8–25	[8, 45, 126, 181, 282, 305, 356]
Doxorubicin (Adriamycin)	0.006–0.02			20–48	[133, 155, 528]
Doxycycline	1–5 (–10)	30		7–20	
Doxylamine	0.05–0.2	1–2	5	9–11	
Dronabinol (Delta-9-tetra-hydrocannabinol, THC)	0.005–0.01 (–0.05)[137]			50–100	[65, 246, 382]
Droperidol	appr. –0.05			1.5–2.5[237]	[133, 155, 450]
Dyphylline	6.5–14 (–20)	40		2	[133, 528]
Edrophonium	–0.15	appr. 0.15		1.3–2.4	[9, 155, 528]
Emetine	appr. –0.1	0.5		?	[133]
Enalapril[52]	0.01–0.05 (–0.1)			8–11	[4, 268]
Encainide[48]	–[175]			1.5–3.5[176]	[155]
Endrin	–0.003	0.01–0.03			[133, 528]
Enoxacin	1–4			3–6	[93]
Enoximone	≥0.2			4–7	[155, 269]
Entacapone	0.4–1.0 (–7.0)			1.5–3.5	[155, 423]
Ephedrine	0.02–0.2	1	5[8]	3–11	[133, 428, 528]
Epirubicin	0.01–0.05			24–52	
Eprosartan	0.4–1.0 (–1.85)			5–9	[155, 423]
Erythromycin	2–6 (–8)	12–15		1–3	[133, 528]
Esmolol	0.15–2			4–16 min	[466]
Estazolam	0.055–0.2			10–24	[133, 155, 528]
Et(h)amsylate	15–20			2.5–4	
Ethacrynic acid	0.05–0.1			1–4	[155, 340]
Ethambutol	0.5–6	10		2.5–3.5	[236, 528]
Ethanol		1000–2000	3500–4000	–[139]	
Ethchlorvynol	0.5–8	20	50	10–25 (–35)	[133, 155, 528]
Ethinamate	1.5–10	50–100	200[8]	appr. 2	
Ethosuximide	30–100 (40–60)	150–200	250	30–60	[60, 145]
Ethylene glycol		200–500	2000		[429]
Etidocaine	0.5–1.5	1.6–2		2–3	[557]
Etilefrine	appr. 0.06			2–3.5	
Etodolac	>14[229]			6–8	[51, 155, 423]
Etomidate	0.1–0.5 (–1)			3.9 ± 1.1 (2–11)	[155, 340]
Etoposide	1–6			4–11	[133, 155, 528]
Ezetimibe	>0.015			appr. 30	[129, 130]
Famotidine	0.02–0.2	0.42[8]		2–4.5	[13, 155, 570]
Fampridine	see 4-Aminopyridine				
Felbamate	50–110[164]	200 (?)		20–24	[167, 522, 542]
Felbinac	appr. 0.4–1 (topical)			10–17	[48, 155]
Felodipine	0.001–0.012	0.01		22–27[88]	[43, 268, 423]
Fenbufen	appr. –60			10–12	[133, 155]
Fendiline	0.02–0.15			appr. 20	
Fenfluramine	0.04–0.3	0.5–0.7	6	1–2, 18–25	
Fenitrothion			1.1		[28]
Fenofibrate	5–30[241]			20–22	[155, 313]
Fenoldopam	0.003–0.06			0.1	[423]
Fenoprofen	(25–) 30–60			2–3	[206]
Fenoterol	(0.001–) 0.01–0.04			appr. 7	

Table (continued)

Substance	Blood-plasma/serum concentration (µg/ml)			$t_{½}$ (h)	Ref.
	Therapeutic ('normal')	toxic (from)	comatose-fatal (from)		
Fentanyl	0.003–0.3[4]		0.003–0.02[8, 103]	1–3.5 (transdermal patch: appr. 17)	[13, 28, 226, 297, 299, 403, 462, 482, 486, 493, 569]
Fexofenadine	appr. –0.3 [191]			14–18	[423, 478]
Finasteride	0.008–0.01			5–7	[499]
Flecainide[48]	(0.2–) 0.4–0.8	1–2	2.6[8]; 13[8]	10–20	[128]
Fleroxacin	1–4			8–13	
Flucloxacillin	3–30			0.7–1.5	
Fluconazole	appr. 1–5 (–15)	20; 95[8]		22–31[83]	[98, 430, 461, 528]
Flucytosine	35–70 (20–50)	100		3–5	[192]
Flumazenil[22]	(0.01–) 0.02–0.1	0.5		1–2	
Flunarizine	0.025–0.2	0.3		–[6]	[426]
Flunitrazepam[23]	0.005–0.015	0.05		10–20	[49, 114, 272]
Fluoride	0.095–0.190 (–0.285)[39]	2	3	short	[155, 391, 407, 497, 527, 528, 552]
5-Fluorouracil	0.05–0.3	0.4–0.6		<0.5	[133, 155, 528]
Fluoxetine	appr. 0.16–0.5	1	6[8]	2–4[6, 130]	[69, 121, 188, 204, 356, 425]
Flupentixol	0.0005–0.002			19–39	
Fluphenazine	0.0002–0.004	0.05–0.1		10–18[45]	
Flupirtine	0.5–1.5	appr. 3–4		7–11	[368]
Flurazepam[24]	0.02–0.1	0.2–0.5	0.8; 24[8]	appr. 2[24]	
Flurbiprofen	5–15			3–4	[138]
Flutamide[60]	0.4–1.5[60]			7–20[60]	[104, 465]
Fluvoxamine	appr. (0.05–) 0.15–0.25	0.65	2.8[8]	15–22	[28, 170, 188]
Furosemide (Frusemide)	1–6	25–30		1–3	[133, 155, 528]
Fusidinic acid	30–200			4–6	
Gabapentin	5.9–21[185]	85[8]		5–8[186]	[28, 44, 64, 400, 483, 500, 519, 562]
Galant(h)amine	appr. 0.03–0.14 (?)			6–8	[38, 474]
Gallopamil	0.02–0.1		8[8]	3–8	[146, 268]
Gamma-hydroxybutyricacid (gamma-hydroxybutyrate, gamma-butyrolactone, GHB, liquid ecstasy)	see 4-Hydroxybutyrate				
Ganciclovir	(0.29–0.51) 0.5–5[107]	3–5		2–4[83]	[252, 358, 476]
Gemcitabine	15–20 µmol/l[146]	–[192]		0.05 (0.18–0.43)	[248]
Gemfibrozil	appr. –25			1.5	[133, 155]
Gentamicin	(2–) 4–10[233]	12		1.5–6	[58, 71, 119, 120, 231, 278, 353, 547]
Glibenclamide (Glyburide)	0.05–0.2	0.6		10	
Glipizide	0.1–1.0 (–1.5)	2		3–7	[429]
Glutethimide	0.2–5	10–30	20–50	5–20	[234]
Glyburide	see Glibenclamide				
Glyceryl trinitrate	see Nitroglycerin				
Gold	3–8	10–15			[528]
Granisetron	0.009–0.017 (?)			3–14	[155, 423]
Griseofulvin	0.3–1.3			22	
Guaifenesin	appr. 0.3–1.4			appr. 1	[155, 423]
Guanethidine	0.01			5–10[6]	[133, 155, 528]
Halazepam[15]	see Nordazepam			30–40	
Haloperidol	0.005–0.017 (0.001–0.02)	0.05–0.5	0.5; 0.18[8, 74]	10–35[153]	[104, 288, 346, 413, 520, 530, 531, 571]
Hematin	50–100			?	
Hemin	see Hematin				
Heptabarb(ital)	0.5–4	8–15	20	6–11	
Heptaminol	appr. 0.2–1 (–1.5)			2–3	
Hexachlorophene	0.003–0.65 (–1)		35	6–44	[133, 528]

Table (continued)

Substance	Blood-plasma/serum concentration (µg/ml)			$t_{½}$ (h)	Ref.
	Therapeutic ('normal')	toxic (from)	comatose-fatal (from)		
n-Hexane	–0.01				[133]
Hexapropymate	2–5	10–20		?	[528]
Hexobarbital	1–5	10–20	50	4–6	
Hirudin-rec	–[171]	–[171]		(1–) 2.5–3	[76, 104, 155]
Hydralazine[5]	0.05–0.5 (–1.5)			2–6	[268]
Hydrochlorothiazide	appr. 0.04–2			10–12	[155, 426]
Hydrocodone	0.01–0.05	0.1	0.2	appr. 4	[423]
Hydromorphone	appr. 0.005–0.015	0.1	0.2	2–3	[176, 340, 423, 427]
4-Hydroxybutyrate (GHB)	appr. 50–120[4]	80 (abuse)	250–280 (abuse)	0.3–0.5 (–1)	[28, 133, 155, 335a, 423]
Hydroxychloroquine	–0.1 (–0.4)	0.5–0.8	4	dose-dependent[6]	[133, 155, 284, 468, 469]
Hydroxyzine	0.05–0.1	0.1	39[8]	7–20	[114, 528]
Ibuprofen	15–30	200		2–3	[28, 140, 206, 556]
Idebenone	0.05–0.2			16–22	[155, 405]
Iloprost	appr. 0.0001			appr. 0.5	
Imatinib	0.72[258]			appr. 18	[113, 320]
Imipenem	0.5–5 (20–75)			1	[513]
Imipramine[48, 125]	0.05–0.35	0.5–1	1.5–2	6–20[26]	[8, 57, 126, 151, 181, 249, 304, 305]
Indinavir	–[260]	0.5		1.5–2	[53, 155, 421]
Indomet(h)acin	0.3–1 (–3)	4–5		3–11	[157]
Indoramin	appr. 0.025–0.1			12 (3.5–15)	[269]
Iproniazid	appr. –5 (?)			?	[133]
Iridium	–0.02				[133]
Iron	0.5–2	6	17		[133, 426, 528]
Isoniazid (INH)	5–10	20	(30–) 100	1–3	[155, 236, 423]
Isopropanol		200–400	1000		[28, 528]
Isosorbid mononitrate (ISMN)	0.1–1			2–5	[269]
Isotretinoin	appr. 0.001–0.002 (topical)[224]			10–20	[155, 349, 375]
Isoxicam	5–15			20–50	
Isradipine	0.0005–0.002 (–0.01)	0.01	0.26[8, 259]	5–10	[78, 155, 268, 439, 523]
Itraconazole	appr. 0.4–2[111]			24–36	[25, 309, 366, 485]
Ivermectin	appr. 0.05[51]			16–28	[155, 384]
Kanamycin	1–4 (10–25)	25–30		0.5–3	
Ketamine	1–6	7 (abuse)	7 (abuse)	1–3	[28, 50a, 114, 191, 499a]
Ketanserin	0.05–0.5			10–22	
Ketazolam[15]	0.001–0.02			1–3	[272]
Ketobemidone	appr. 0.3		0.6	2–2.5	[28, 50a, 155, 499a]
Ketoconazole	1–3 (–6)			6–10	[423]
Ketoprofen	1–6 (–20)		1100[8]	1,5–2 (–4)	[21, 28, 106, 206, 237, 302, 364]
Ketorolac	0.5–3	5		4–10	[155, 423]
Ketotifen	0.001–0.004	0.02	1.2[8]	21	[428]
Labetalol	0.03–0.18 (–0.65)[50]	1		3–10	[155, 269, 466]
Lacidipine	0.003–0.006			12–19	[423]
Lamivudine	–[230]			(3–) 5–7	[155, 247]
Lamotrigine	(1–5) 3–14	15–30	50[8]	24–36[109]	[28, 64, 419, 453, 519]
Lead	–0.16 (–0.3)	0.4–0.6	3	–[6, 180]	[28, 133, 155, 452, 456]
Leflunomide[255]	8.8 ± 2.9, 18 ± 9.6, 63 ± 36[256]			11 (4–28)[6]	[32, 155, 163, 316]
Levetiracetam	10–37	400[8; 264]		5–8	[27]
Levocabastine	<0.001–0.01[147]			33–40	[209]

Table (continued)

Substance	Blood-plasma/serum concentration (μg/ml)			$t_{½}$ (h)	Ref.
	Therapeutic ('normal')	toxic (from)	comatose-fatal (from)		
Levodopa (L-Dopa)	0.3–1.6		650[8]	1–3[215]	[15, 182–184, 507]
Levomepromazine[27]	0.005–0.025 (–0.2)	0.4	0.5	15–30[28]	
Levomethadone	0.04–0.3	1	0.2	10–40	[155, 451]
Levorphanol	0.007–0.02	0.1	2.7[8]	11–30	[423]
Levothyroxine	0.045–0.14[47]			6–8[6]	[143]
Lidocaine (Lignocaine)	(1–) 1.5–5[113]	6–7	10	1–4[113]	[95, 189, 231, 557, 567]
Lisinopril	(0.005–) 0.02–0.07	0.5		12	[268]
Lithium	4–8[79]	13	14	8–50[28]	[5, 161, 305, 356, 361]
Lofepramine	0.003–0.01			10–20	
Loperamide	–[84]			7–15	
Loprazolam	0.003–0.01			11–20	[272]
Loratadine	0.001–0.02[138]			8–14	[418, 575]
Lorazepam	(0.02–) 0.08–0.25	0.3–0.5		10–40	[203, 272, 424, 431]
Lorcainide	(0.04–) 0.1–0.4 (–0.9)			5–10	
Lormetazepam	0.005–0.025 (–0.1)			10–15	[272]
Losartan	<0.2[227]			1.5–2	[155]
Loxapine	0.01–0.03 (–0.1)	1	7.7	4 (1–14)	[133, 528]
Lysergide (lysergic acid diethyl amide, LSD)	0.0005–0.005	0.001	0.002–0.005	appr. 2–5	[317, 423, 528]
Magnesium	55–75[121]	120–140	150–180		[155, 558]
Malathione		0.5	175[8]		[28, 133]
Manganese	0.0005–0.0015				[133]
Maprotiline	0.1–0.6 (0.1–0.25)	0.5–1	1–5	20–60	
MCPA	see 2-Methyl–4-chloro-phenoxyacetic acid				
MCPP	see 2-Methyl–4-chloro-phenoxypropionic acid				
Mebendazole	≥0.1[67]	appr. 0.6		2.8–9	[104]
Medazepam[30]	0.1–0.5 (–1)			2–5	
Mefenamic acid	2–10 (–20)	25		2–4	[340, 468, 469]
Mefloquine	0.4–1[108]	1.5–2[8]		appr. 21[6]	[68, 199]
Melitracen	0.01–0.1			12–23	
Meloxicam	0.4–2			17–22	[373, 423]
Melperone	<0.2[219]		17.1[8]	4–8	[228, 423, 496a]
Melphalan	–1.5			1.5–2	
Meperidine	see Pethidine				
Mephenesin	3–10 (?)			appr. 2–4	[423]
Mepindolol	0.007–0.07			3–6	[466]
Mepivacaine	appr. 0.4 (–4)	5–6 (–10)	50	1–3	[423]
Meprobamate	5–10	10–25	30	6–17	[114]
Meptazinol	0.025–0.25			2–3	
Mercury	appr. 0.0015–0.002 (<0.005)[178]	0.05–0.2	0.5	appr. 3[6]	[133, 155, 372, 429, 481]
Mesalazine (Mesalamine)	–appr. 1[119]			0.5–2.4[120]	[271]
Mesoridazine	0.15–1	3–5	3[8]; 4[8]; 16[8]	20	[423]
Mesuximide	see Methsuximide			1–2	[155]
Metaclazepam	0.05–0.2			7–23	[272]
Metamizole (Dipyrone)[5]	10[32]	20[32]		6–8	[423]
Metformin	0.1–1 (0.6–1.3)	5–10	64[8]; 85[8]; 91[8]; 166[8]	2–4 (–10)	[101, 422]
Methadone[135]	(0.05–) 0.1–0.5 (–0.75)	0.2	0.4	23–25 (13–55)	[218, 232, 233, 457, 525]
Methamphetamine	0.01–0.05	0.2–1	10–40	6–9	[423]
Methanol	appr. –2	200	900		[133, 423, 528]
Methapyrilene	appr. 0.1	4			[133]
Methaqualone	1–3	3–5	5–10	10–40	

Table (continued)

Substance	Blood-plasma/serum concentration (µg/ml)			$t_{½}$ (h)	Ref.
	Therapeutic ('normal')	toxic (from)	comatose-fatal (from)		
Methemoglobin	–[199]	25–30%	60–70%		[155, 527, 528]
Methimazole	0.5–2			2–28	[317, 423]
Methocarbamol	25–40 (–50)	250		0.9–2	[133, 155, 528]
Methohexital	(0.5–) 1–6[55]			1–3	
Methomyl			28 (8–57)		[28]
Methotrexate	0.04-?	0.4		2–10	
Methotrimeprazine	see Levomepromazine				
Methoxsalen (8-Methoxypsoralene)	0.025–0.1 (–0.2)	1			[155, 527]
Methsuximide (Mesuximide)[223]	10–40	40–50		20–40	[155, 496, 528]
D-Methylamphetamine	–0.1	1			[133]
2-Methyl–4-chlorophenoxy-acetic acid (MCPA)	–	appr. 100	appr. 180	–[187]	[155, 459]
2-Methyl–4-chlorophenoxy-propionic acid (MCPP)	–	appr. 100	669[8]; 715[8, 181]	17[183]	[155]
Methyldopa	1–5	9[8]		1.5–3	[340, 468, 469]
Methylenedioxyamphetamine (MDA)	–0.4	1.5	2		[317, 423, 528]
Methylenedioxyethyl-amphetamine (MDEA)	0.2		1		[28]
3,4-Methylenedioxymethyl-amphetamine (XTC, MDMA)	0.1–0.35[236]	0.35–0.5	0.4	9–10	[75, 317, 423, 528]
Methylphenidate	0.01–0.06	0.5; 1[8]	2.3	2–7	[427]
4-Methylthioamphetamine (4-MTA, p-MTA)			2[8]; 4.2[8]; 7.4[8]		[46, 123, 410, 512, 549]
Methyprylon(e)	<10–20	12–75	50 (–100)	3–6, 9–11	
Metiamide	0.01–0.06			?	[528]
Metildigoxin[3]	0.0005–0.0008	0.0025–0.003	0.005	40–70	[420, 516]
Metipranolol[33]	0.02–0.08			2–3.5	
Metoclopramide	0.05–0.15	0.2	4.4[8]	3–6	[429]
Metocurine	appr. –0.4			?	[133]
Metoprolol[48]	0.035–0.5	0.65[8]; 12–18	4.7[8]; 12[8]; 63[8]	3–6	[28, 155, 466]
Metrifonate	appr. 1.4–3.6			2–5	[423]
Metronidazole	3–10 (–20)	200[8]		6–10 (–14)	[423]
Mexiletine	(0.5–) 0.7–2	2.5	35[8]	5–26	[338]
Mianserin	0.01–0.15	0.5–5		8–19	[114]
Miconazole	appr. 1			24	
Midazolam	0.04–0.1 (–0.25)[134]	1–1.5		1.5–3[46]	[16, 42, 227, 293, 431]
Mifepristone	–[216]			24–48 (20–54)	[196]
Milrinone	0.15–0.25	0.3		1–2	[155, 269, 426]
Minaprine	appr. –0.1			?	[133]
Minoxidil[149]	appr. 0.02–0.25	1.4[8]; 3.1[8]	2.7[8]	2.8–4.2	[28, 155, 268]
Mirtazapine	–0.3	1–2		20–40[188]	[155, 501]
Mizolastine	appr. 0.2–0.8			8–17	[155, 423]
Moclobemide[141]	appr. 0.5–1.5 (–3)	11[162]; 25–60		1–3	[150, 175, 239, 336, 363, 365]
Modafinil	appr. 2–3[257]			12–15	[201, 352]
Molindone	appr. –0.5			?	[133]
Molsidomine	0.002–0.01			1–2.5	[269]
Molybdenum	–0.005				[133]
Montelukast	appr. 0.05–0.3			3–6	[155, 423, 574]
Moricicine	appr. 0.12–1.27			6–13	[317, 423]
Morphine	0.01–0.1	0.1	0.1–4	1–4	[1, 65, 159, 253]
Moxonidine	0.001–0.002 (–0.004)			2–3	[155, 269]
Muromonab-CD3 (OKT 3)	appr. 0.7–1.3			appr. 18	
Mycophenolate mofetil	–[211]			16–18[212]	[33, 149, 225, 448]
Nabumetone	–[206]			–[206]	[155, 560]

Table (continued)

Substance	Blood-plasma/serum concentration (μg/ml)			$t_{½}$ (h)	Ref.
	Therapeutic ('normal')	toxic (from)	comatose-fatal (from)		
Nadolol	0.01–0.25		1.3[8]	14–24	
Naftidrofuryl (Nafronyl)	<0.5			1–2	[133]
Nalbuphine	0.02–0.2			2.5–7	
Nalidixic acid	10–30	40–50		1 (–7)	[155, 340, 423]
Nalmefene	–0.1			8.5–11	[133, 155]
Naloxone	0.01–0.03			1–2	
Naltrexone	–0.05[99]			4–10	
Naproxen	20–50 (–100)	200–400; 414[8]		10–20	[90, 206, 335, 556]
Naratriptan	appr. 0.01–0.05			5–6	[155, 423]
Nebivolol	<0.02 (–0.2)	0.48[8]		10 (8–27)	[155, 197, 211, 337]
Nedocromil	<0.025			1.5–3.3	[133, 155]
Nefazodone	appr. 0.01–0.3 (?)[220]	5.5[8, 221]		2–7[222]	[23, 94, 153, 155, 169, 262, 445]
Nefopam	0.01–0.1	4[8]	12[8]	3–8	
Neostigmine	appr. 0.001–0.01[127]			0.4–1.3	[9, 74]
Netilmicin	1–12			2–3[80]	
Nicardipine	0.07–0.1			7–12	[268]
Nickel	–0.003	0.005			[133, 528]
Nicotine[123]	0.005–0.02 (–0.03)	0.4 (–1)	5; 13.6[8]	1–4[124]	[155, 255, 426]
Nicotinic acid	4–18			0.3–1	
Nifedipine	0.025–0.1	appr. 0.15–0.2	5.4[8]	2–5	[28, 268]
Niflumic acid	2–35			2–3	[423]
Nilvadipine	<0.01			11–20	[268]
Nimesulide	appr. 1–3[235]			2–7	[34, 155, 423]
Nimodipine	0.01–0.05			1–2 (8–9)	[268]
Nimustine	0.0002–0.0005			?	[528]
Nisoldipine	0.0003–0.001			7–12	[155, 268]
Nitrazepam	0.03–0.1	0.2–3	5 (?)	20–30	
Nitrendipine	0.01–0.05			8–12	[268]
Nitrofurantoin	1–3	3–4		1 ± 0.3	
Nitroglycerin (Glyceryl trinitrate)	appr. –0.015			20–30 min	[355]
Nitroprusside	see Thiocyanate	see also Cyanide			
Nizatidine	0.05–0.5 (–1.0)			0.7–2.1	
Nomifensine	0.01–0.1	8–10		2–5	
Nordazepam	0.02–0.2 (–0.8)	1.5–2		40–80	
Norephedrine	see Phenylpropanol-amine				
Norfenefrine	–0.4			2–3	
Norfloxacin	0.5–5			3–4	[155, 528]
Normesuximide[31]	10–30	40		38	
Nortriptyline[48]	0.02–0.2 (0.05–0.15)	0.5	1–3	18–56[68]	[151, 305, 345, 415]
Obidoxime	1–10 (appr. 10–15 μmol/l)				[133, 518, 528]
Ofloxacin	appr. 2.5–5.5	(30–) 40[8]		(3–) 5–8	[155, 289]
OKT 3	see Muromonab-CD3				
Olanzapine	appr. 0.02–0.03 (–0.05)	0.2	1[8]; 4.9[8]	33 (21–54)	[28, 73, 121a, 423, 477a, 528]
Omeprazole[48]	–[98]			0.5–1 (–1.5)	
Ondansetron	0.03–0.3			3–5.5	[429]
Opipramol	0.1–0.5	2–3	7–10	6–12[262]	[104, 264]
Orphenadrine	0.1–0.2 (–0.6)	1.7	3.6[8]; 5–7	14–18	[86, 114, 340]
Oxatomide	0.02–0.1			14–30	[133, 155]
Oxazepam	0.2–1.5	2	3–5	6–20	[107, 155, 272, 468]
Oxazolam[15]	see Nordazepam			1–2	
Oxcarbazepine	12–24[172]			1–2.5[172]	[155, 517, 519]
Oxpentifylline	see Pentoxyfylline				
Oxprenolol	0.05–0.3 (–1.0)	2–3	10	1–4	[466]

Table (continued)

Substance	Blood-plasma/serum concentration (µg/ml)			$t_{½}$ (h)	Ref.
	Therapeutic ('normal')	toxic (from)	comatose-fatal (from)		
Oxycodone	(0.005–) 0.02–0.05	0.2	0.6; 5[8]	2–5[53]	[340, 426, 528]
Oxyfedrine	appr. 0.06			4.2	[269]
Oxypurinol[61]	5–15	20		18–30	[528]
Oxytocin	appr. –0.0002			3–5 min	[133, 155]
Paclitaxel	0.085–1 (?)[122]			4–8 (–13)	
Pamidronate	appr. 0.5–1			appr. 2.5	
Pancuronium	0.1–0.6	0.4[8; 198]	1.6	1.5–2.5	[536]
Pantoprazole	appr. –4.6			1–2	[155, 423]
Papaverine	(0.2–) 0.6–1 (–2)			1–2, 6–7	[428]
Paracetamol	(5–)10–25	100–150	200–300	2–4	[50, 166, 260, 331, 369, 442, 455, 484, 487, 535]
Paraldehyde	10–100	200	400–500	4–10	
Paraoxon	–	0.005			[528]
Paraquat	–	0.05	1–2[201]		[155, 187, 528]
Parathion	–	0.01–0.05	0.05–0.08		[155, 527, 528]
Paroxetine[48]	<0.01–0.05 (–0.1)	0.35–0.4		16–24[93]	[69, 170, 188, 283, 479, 480]
Pefloxacin	1–10 (3–6)	25		8–15	
Pemoline	appr. 1–7			7–13	
Penbutolol	0.01–0.3 (–1.0)			20–26	[466]
Penfluridol	0.004–0.025			70	[155, 528]
(D–)Penicillamine	1.7–5.6 (–11)			1–3	
Pentachlorophenol	–0.2	30	45		[133, 528]
Pentamidine	appr. 0.3–0.5			6–9	[155, 423]
Pentazocine	0.01–0.2	1–2	3	2–5	
Pentobarbital	1–10	10–19	15–25	20–40	
Pentoxifylline[72]	appr. 0.5–2			0.5–2 (4–6)	
Perazine	0.02–0.35	0.5 (6.1[8])		8–16 (–35)	[164, 423]
Perici(y)azine	0.005–0.03	0.1		?	[340]
Perindopril	0.08–0.15			0.8–1.5[265]	[155, 423]
Perphenazine	0.001–0.02 (0.0008–0.0024)[161]	0.05		8–12 (–21)	[308]
Pethidine[115]	0.1–0.8	1–2	2 (–3)	3–6 (–10)	[10, 31, 177, 215, 257]
Phenacetin[62]	5–10 (–20)	50		appr. 1	[340, 468]
Phenazone (Antipyrine)	5–25	50–100		10–12	
Phencyclidine (PCP)		0.007–0.24	1–5	1–12	[317, 423, 528]
Phendimetrazine	0.02–0.24 (–0.3)			2–4	[133]
Phenelzine	0.001–0.002 (–0.04)	0.5	1.5	6–8	[155, 528]
Phenformin	0.03–0.1	0.6	3	4–13	[155, 423]
Pheniramine	0.01–0.27		2 (?)	16–19	[155, 423]
Phenmetrazine	0.02–0.25	0.5	4	ca. 8	
Phenobarbital	10–30 (15–40)	30–40	50–60	60–130	[60, 145, 157]
Phenol		50	90		[133, 528]
Phenprocoumon	0.16–3.6 (1–5)	appr. 5		100–160[35]	[528]
Phensuximide	4–10 (–20)	80		4–12	[423, 528]
Phentermine	0.03–0.1	0.9	1	appr. 20	[423, 528]
Phenylbutazone[36]	50–100	120–200	400	30–175[37]	[340, 468]
Phenylephrine	0.04–0.1			2–3	[423]
Phenylpropanolamine (Norephedrine)	0.1–0.5	2	48	3–7	[155, 340]
Phenytoin	5–15 (10–20)[81]	20–25	43[8]; 50	10–60[37]	[6, 55, 145, 147, 193, 221, 351, 362, 416]
Pholcodine	appr. –0.2			?	[133]
Physostigmine	<0.001–0.005			0.4–1	[9, 14, 230]
Pimozide	appr. 0.004–0.01 (–0.02)			24–55	

Table (continued)

Substance	Blood-plasma/serum concentration (µg/ml)			$t_{½}$ (h)	Ref.
	Therapeutic ('normal')	toxic (from)	comatose-fatal (from)		
Pinazepam[15]	0.01–0.05			16	[272]
Pindolol	0.02–0.15	0.7–1.5		2–5	[466]
Pipamperone	0.1–0.4	0.5–0.6		<4	
Piperacilline	1–5 (20–70)			1–2	[423, 528]
Piperazine	0.02–0.1	0.5			[426, 429, 528]
Pipotiazine	0.001–0.06	0.1		8–11	[155, 340, 423, 528]
Piracetam	appr. 20–50			4.5–7	
Pirenzepine	0.03–0.45			8–20	
Piritramide	0.0088 ± 0.0053[128]			4–10	[266]
Pirmenol	1–4			6–18	[155, 528]
Piroxicam	2–6	14[8]		30–70	
Pizotifen	0.007–0.009			26	
Prajmalium[48]	0.06–0.44			5–7	
Pramipexole	appr. 0.0002–0.007			8–14	[317, 423]
Pranlukast	appr. 0.2–1.2			appr. 2–9	[155, 423]
Prazepam[15]	0.2–0.7	1		1–3	
Praziquantel	appr. 0.2			1–2.5	
Prazosin	0.001–0.02	0.9		2.9 ± 0.8	[269, 426]
Prednisolone	0.5–1			2–6	
Prilocaine	0.5–1.5 (–2)[126]	5–6	appr. 20	1–2	[162, 557]
Primaquine	appr. 0.1–0.2			4–7	[423]
Primidone[63]	4–12 (8–15)	20–50	65	4–12, 9–22	[60, 145]
Probenecid	100–200 (20–150)			3–17[37]	
Procaine	0.2–2.5 (–10)	15–20	20	–0.5	[423, 528]
Procainamide[5]	4–10 (3–9)	10–15	20	2–5	
N-Acetylprocainamide[38]	5–30 (10–35, 15–40)			3–7	
Prochlorperazine	0.01–0.05	0.2–0.3	5	7–9 (–18)	[155, 340, 528]
Procyclidine	0.08–0.63	1–2	7.8[8]	7–16	[423, 528]
Proguanil[48]	appr. 0.04–0.15[114]			13–24[114]	[117]
Promazine	0.01–0.05 (–0.4)	1	5	5–41 (8 ± 7)	
Promethazine	0.05–0.2 (–0.4)	1–2	2.4[8]; 1.8–5.4[250]	8–15 (–20)	[114, 506]
Propafenone[48]	0.4–3 (0.06–1)	2–3	7.7[8]	5–8, 2–32[48]	[244, 426]
Propallylonal	0.3–10	>10		appr. 3	
2-Propanol	see Isopropanol				
Propantheline	appr. –0.02			1–3	[133, 155]
Propiomazine	<0.3 (?)			8–10	[114, 190]
Propofol	appr. 2–8			3–8[91]	[11, 299]
Propoxyphene	see Dextropropoxyphen				
Propranolol	0.02–0.3	(0.5–) 1–3	4–10	2–6	[466, 504]
Propylene glycol	0.05–0.5	1000–2000; 4700[8]			[62, 528]
Propylhexedrine	0.01	0.5	2–3	?	[133, 528]
Propyphenazone	3–12			1–1.5 (–3)	[340, 468, 469]
Prothipendyl	appr. 0.05–0.2	appr. 0.5 (–1)		2–3	
Protriptyline	0.05–0.3	0.5	1	50–200	
Pseudoephedrine	0.5–0.8		19–20	9–16	[423, 528]
Pyrazinamide	30–75			9–10 (–25)	[110, 155, 340]
Pyridostigmine	<0.05–0.2			1–2.5	[9, 554, 559]
Pyridoxine	0.003–0.018			3–6	[429]
Pyrimethamine	appr. –1.5			80–96	[133, 155]
Pyrithyldione	1–10			11–20	[340, 468, 469]
Quazepam[131]	0.01–0.05 (–0.15)			39 (25–41)	[272, 423, 528]
Quetiapine	<1[239]	1.8[8]	12.7[8]	appr. 5–7[240]	[12, 102, 185, 374, 408]
Quinidine[48]	1–5	6–10	10–15	4–12	[357]
Quinine	1–7	10		4–15	[115, 390]

Table (continued)

Substance	Blood-plasma/serum concentration (μg/ml)			$t_{½}$ (h)	Ref.
	Therapeutic ('normal')	toxic (from)	comatose-fatal (from)		
Rabeprazole	appr. −0.6			1–2	[423]
Ramipril	appr. 0.001–0.01[228]			1–5	[155]
Ranitidine	0.05–1			2–4	[344]
Reboxetine	C_{max} < 0.3			12–14	[135, 155]
Recainam	1.3–5.7			5–7	[7]
Remoxipride	2.15 ± 0.59[132]		41–150	5–10	[114, 250, 290]
Retinol (Vitamin A)	0.2–0.8 (0.7–2.8 μmol/l)				[342, 429]
Ricin		0.0005			[276a]
Rifabutin	0.05–0.15			45 (?)	[155]
Rifampicin (Rifampin)	0.1–10[101]		55[8]	2.3–5	[28, 110, 236, 407a]
Rifapentine	?			13.2	[110]
Riluzole	appr. 0.05–0.5 (−1.5)			9–15	[317, 423]
Risperidone[48]	appr. 0.006[158]		1.8[8]	2–4[159]	[28, 401]
Ritonavir	appr. 5–11 (−20)			3–5	[155, 224]
Rivastigmine	?			1–2	[230, 423]
Rizatriptan	appr. −0.1			2–3	[155, 423]
Ropinirole	0.0004–0.006[254]			6 (2–10)	[263]
Ropivacaine		(1–) 2[173]		2[168]	[125, 332, 473]
Roxatidine	0.1–0.8			5–6	
Roxithromycin	4–12			12	[17, 155]
Salbutamol (Albuterol)	<0.01–0.02	0.1–0.15[116]	0.16	3–6	[303, 528]
Salicylamide	5–40			appr. 1	
Salicylic acid	20–200	300–350	(400–) 500	3–20	[77, 155, 207, 234, 329, 334, 409]
Scopolamine	0.0001–0.0003 (−0.001)			appr. 3	[423, 528]
Secbutabarbital	5–10 (−15)	20	30	34–42	
Secobarbital	1.5–5	7–10	10–15	15–30	
Selegiline	see Amphetamine and Methamphetamine			1.2	[155]
Selenium	0.045–0.13	0.4			[133, 155, 359]
Sertraline	0.05–0.25 (–0.5)	0.29[8]	1.6[8]; 3[8]	24–28	[28, 317, 345a, 423, 528]
Sildenafil	appr. 0.05–0.5			3–5	[155, 423]
Silver	−0.005	0.06–0.6			[528]
Sirolimus	0.005–0.015[244]	0.015 (−0.06)		57–63	[155, 256, 322, 324, 576]
Sodium nitroprusside	see Thiocyanate			0.1	
Sodium oxybate (GHB)	see 4-Hydroxybutyrate				
Sodium valproate	see Valproic acid				
Sotalol[167]	0.5–3 (–4)	7.5–16[8]	40[8]; 43[8]	5–13 (–17)	[118, 466, 498]
Sparteine[48]	0.5–1			2.6	
Spiramycin	appr. −3			5–8	[61, 155]
Spironolactone	(0.05–) 0.1–0.25 (–0.5)[73]			13–24[73]	[423, 528]
Stiripentol	appr. 4–22	20		13	[133, 155]
Streptomycin	1–5 (15–40)	40–50		2–4	[317, 423, 528]
Strontium	−0.03				[133]
Strychnine		0.075–0.1	0.2–2	appr. 10–15	[423, 528]
Sufentanil	0.0005–0.01[4]		0.001–0.007[8]	2–5, 22	[19, 28, 52, 194, 226, 403, 460, 462]
Sulbactam	−80			1–2[70]	[88, 155]
Sulfamethoxazole	30–60[56]	200–400		9–12	[155, 389]
Sulfasalazine[34]	5–30 (–70)			4–10	
Sulfinpyrazone	6–17			3–5	
Sulindac	1–5[102]			appr. 7	[91]

Table (continued)

Substance	Blood-plasma/serum concentration (µg/ml)			$t_{½}$ (h)	Ref.
	Therapeutic ('normal')	toxic (from)	comatose-fatal (from)		
Sulpiride	0.05–0.4 (–0.6)[225]		3.8[8]; 38[8]	4–7	[28, 104, 155, 528]
Sultiam (Sulthiame)	0.5–12.5 (6–10)	12–15	20–25	3–30	[496]
Sumatriptan	0.018–0.06			2	[423]
Suramin	>100[117]	300[118]		44–54	[281]
2,4,5-T	see 2,4,5-Trichlorophenoxyacetic acid				
Tacrine	appr. 0.01			2–4	[230]
Tacrolimus (FK–506)	0.005–0.015 (–0.02)	(0.015–) 0.02–0.025		9–16	[216, 254, 306, 360, 511, 528, 533, 538–540, 543, 564]
Talinolol	0.04–0.15		5[8, 129]; 20[8]	10–14	[466, 514, 515]
Talipexole	appr. 0.0001–0.001			5–9	[423]
Tamoxifen	0.05–0.5			5–7[6]	[133, 155]
Taxol	see Paclitaxel				
Teicoplanin	(10–) 15–20 (–40)	200		10–15; 83–168[83]	[243, 561]
Temazepam	0.02–0.15 (–0.9)	1	8.2[8]; 14[8]	6–25	[139, 272, 423, 528]
Tenoxicam[174]	appr. 5–10			(50–) 70–90	[198, 370]
Terazosin	appr. 0.02–0.08			8–12	[423]
Terbinafine	0.01–0.03[205]			22–26	[155, 527, 528]
Terbutaline	0.001–0.006 (–0.01)		0.04	16–20[89]	[423, 528]
Terfenadine	<0.01	0.06[148]	0.4[8]	15–22[64]	[28, 155, 566]
Tetrachloroethylene			4–5		[528]
Tetracycline	1–5 (5–10)	30		6–10	[155, 423, 528]
Tetrazepam[40]	0.05–0.6 (–1)			10–26	[272]
Thalidomide	0.5–1.5 (–8)			5–9	[155, 423]
Thallium		0.1–0.5[179]; 5.6[8]	0.5–11	–[6]	[59, 155, 528]
Theobromine	10–15	20		6–10	[528]
Theophylline	(5–) 8–15 (–20)[82]	20	50	6–9[41]	[84, 103, 120, 122, 157, 180, 217, 267, 404, 447, 475, 508, 553]
Thiamphenicol	0.5–3–10 (–15)	20		2–7	[423]
Thiazinamium	0.05–0.15	0.3			[317, 423, 528]
Thiocyanate from Nitroprusside	1–12[144] 5–30	35–50 50–100	200	3–4[6]	[3, 155, 446, 528]
Thiopental[57]	1–5		10–15[58]	3–8	
Thioproperazine	appr. 0.001–0.02	0.1			[423]
Thioridazine[133]	0.1–2 (0.2–0.8–1.25)[133]	2.5–5	3–10	7–13 (–36)	[114]
Thiothixene	see Tiotixene				
Thyroxine	see Levothyroxine				
Tiagabine	0.05–0.2 (?)	0.5–0.6; 3.1[8, 245]		7–9 (4–13)	[2, 155, 294, 295, 318, 399, 423, 519]
Tiapride	max. 1–2			appr. 3–4	[423]
Tiaprofenic acid	appr. 15–40[193]			1.5–3	[89, 155, 414]
Ticlopidine	<1–2 (?)			0.8[100]	
Tilidine[25]	0.05–0.12		1.7[8]	appr. 3	
Tiludronate	0.2–1.5			65–78 (–150)	[472]
Timolol	0.005–0.05 (–0.1)			2–6	
Tin	0.03–0.14				[133, 528]
Tinidazol	max. –60			11–15	[133, 155]
Tiopronin	appr. 2–5			23 ± 11	[158]
Tiotixene	0.001–0.03 (0.002–0.014)	0.1		34–36	[346]
Tizanidine	appr. 0.015			appr. 2.5	[155]
Tobramycin	4–10[154]	12–15		2–3	[71, 155, 454, 489]
Tocainide	4–12 (6–10)	13–15; 20[8]	74[8]; 140[8]	8–25	[23a, 28, 155, 292]
Tofenacine	0.025–0.1	0.5–1			[340, 528]
Tolbutamide	50–100	400–500	640[8]	4–12	[26, 528]

Table (continued)

Substance	Blood-plasma/serum concentration (µg/ml)			$t_{½}$ (h)	Ref.
	Therapeutic ('normal')	toxic (from)	comatose-fatal (from)		
Tolmetin	10–80	60 (?)		2–4	[528]
Toluene			10		[528]
Topiramate	3.4–5.2 (–10?)[218]			20–30	[399, 423, 519]
Topotecan	appr. 0.001–0.01[190]			2–3	[152, 155, 205]
Tramadol[48]	0.1–1 (>0.3)[87]	1	2[8, 49]; 13[8]; 38.3[8, 252]	5–10	[35, 298, 341, 528]
Tranexamic acid	10–50			10	
Tranylcypromine	–0.2 (?)	0.5[8, 202]	0.7[8]; 5[8]	1.5–3.5	[238]
Trapidil	(4–) 6–10			2–6, 12	[155, 269, 339]
Trazodone[145]	(0.5–) 0.8–1.6	4	12–15[8]	4–8 (6–13)	[104, 381]
Triamterene	0.01–0.1			1.5–4	[155, 426]
Triazolam	0.002–0.02	0.04		2–5	[229, 272, 366]
2,2,2-Tribromoethanol		50	90		[133, 528]
Trichloroethane			100–1000		[528]
2,2,2-Trichloroethanol	5–15	40–70	60–100		[28, 133, 528]
2,4,5-Trichlorophenoxyacetic acid (2,4,5-T)	–	appr. 100	200	23–33	[155, 528]
Trifluoperazine	0.001–0.01 (0.05)	0.1–0.2		7–18	
Triflupromazine	0.03–0.1	0.3–0.5		appr. 6	
Trihexyphenidyl	–[75]	0.5		3–5	[340, 524]
Trimeprazine	see Alimemazine				
Trimethadione	20–40			?	[528]
Trimethobenzamide	1–2			?	[133, 528]
Trimethoprim	1.5–2.5[56]	20		8–11	[155, 389]
Trimipramine	0.01–0.25	0.5	1.7–8.2[251]	10–20 (–40)	[114]
Tripelennamine	0.02–0.06		10	5–8	[423, 428, 528]
Triprolidine	0.004–0.045			2–5	[428]
Tropisetron	appr. 0.02–0.05			5.6–8.6	[429]
Tubocurarine	(0.6–) 1–3 (–6)			2–4	
Tungsten	–0.035				[133]
Urapidil	appr. 0.1–0.2			2.7–7	[155, 269]
Valdetamide	see Diethylpentenamide				
Valnoctamide	5	40		?	[528]
Valproic acid	40–100 (50–150)	150–200	720[8]	10–20 (7–17)	[28, 60, 145]
Vanadium	–0.05				[133]
Vancomycin	≤5–10 (–12)[142]	30		4–11[83]	[28, 71, 119, 144, 296, 323, 330, 394, 551]
Vecuronium	appr. 0.2–0.37 (–0.5)			1–1.5	[133, 155, 340]
Venlafaxine	appr. 0.2–0.4[189]	1–1.5[266]	6.6[8]	3–5	[28, 270, 528]
Verapamil[90]	(0.01–) 0.02–0.25 (–0.4)	1	2.5; 3.9[8]	6–14[42]	[114, 268, 292, 319, 471]
Vigabatrin	2–9 (–15)[94]			5–8	[28, 519]
Viloxazine	–6.0–8.0 (?)			2–5	[104, 155, 423]
Vincamine	<0.25 (?)			1–2 (8–17)	
Vinylbital	1–3	5	8	18–33	
Viquidil	appr. 0.15–0.25			6–12	
Vitamin A	see Retinol				
Vitamin C	see Ascorbic acid				
Vitamin D	>50 nmol/l[263]			appr. 30[6]	[328]
Warfarin	1–3 (–7)	10–12	100	37–50[97]	[155, 426, 469, 555]
Wismut	see Bismut(h)				
Xamoterol	appr. 0.02–0.04 (–0.1)			7–8	[133, 155]
Xipamide	–20			5–8	[133, 155]
Xylene			3–40		[528]
Yohimbine	appr. 0.05–0.3			1–3	[133, 423]
Zafirlukast	0.005–0.03			10	[155, 423]

Table (continued)

Substance	Blood-plasma/serum concentration (μg/ml)			$t_{½}$ (h)	Ref.
	Therapeutic ('normal')	toxic (from)	comatose-fatal (from)		
Zalcitabine	appr. 0.1 (0.5 μmol/l)			1–3[83]	[66, 358]
Zanoterone	0.1–0.5				[568]
Zidovudine[51]	0.1–0.3 (–1)	2–3		1–1.5	[66, 136, 137, 155, 212, 358]
Zinc	0.6–1.3	2	42[8]		[429]
Zipeprol	0.1–0.7		5.8[8]; 10.6[8]	?	[133, 428]
Ziprasidone	0.02–0.06			2–7	[155, 423]
Zolmitriptan	appr. 0.007–0.01			2.5–3	[423]
Zolpidem	0.08–0.15 (–0.2)	0.5	2–4	2–5	[96, 114, 154, 155, 160, 282, 423, 528, 563]
Zonisamide	(15–) 20–30 (–40)	(30–) 40–70	100[208]	50–70[209]	[276, 347, 399, 519]
Zopiclone	<0.1	0.15	0.6–1.8	3.5–8	[114, 155, 423, 528]
Zotepine	0.01–0.15	0.15–0.2		14–16	[155]
Zuclopenthixol[48]	0.005–0.1	0.15–0.3		appr. 20	[423, 469]

Clinical categories used for grouping analytical data:
Therapeutic: blood-plasma/serum concentrations (in general, trough at steady state) observed following therapeutically effective doses; no, or only minimal, side-effects (drugs); 'normal': concentrations associated with no, or only minimal, toxic effects (other xenobiotics).
Toxic: blood-plasma/serum concentrations which produce toxicity.
Comatose-fatal: blood-plasma/serum (comatose) concentrations and whole blood (fatal) concentrations reported to have caused coma and death, respectively.
$t_{½}$: in general, terminal elimination half-life.
Ref.: if not specifically referenced, data was taken from review articles [13, 28, 40, 41, 57, 63, 72, 99, 100, 104, 105, 109, 111, 112, 114, 133, 155, 165, 240, 272, 317, 340, 354, 376, 378, 393, 395, 423, 426–429, 441, 443, 466, 468, 469, 489, 491, 495, 510, 527, 528, 534] and/or supplemented with our clinical and forensic analytical results.

Annotations

[1] active metabolite of acebutolol
[2] as salicylic acid (for analgesic and antipyretic effect)
[3] as digoxin
[4] during mechanical ventilation
[5] slow (poor) and rapid (extensive) acetylators (metabolizers)
[6] days
[7] active metabolites nortriptyline (see Table) and amitriptyline oxide ($t_{1/2}$: 1.5–3 h)
[8] case report
[9] in patients with impaired renal function in some cases up to 100 h
[10] active metabolite 6-mercaptopurine ($t_{½}$: 1–1.5 h)
[11] appr. 0.2 h for azathioprine
[12] active metabolite carbamazepine-10,11-epoxide ($t_{1/2}$: 5–16 h; usual plasma concentration range 0.2–2 μg/ml) should be considered in case of intoxication
[13] each sum carbromal(um) + carbromide ($t_{1/2}$: 12–15 days)
[14] each as trichloroethanol
[15] active metabolite desmethyldiazepam = nordazepam (see Table)
[16] nephrotoxic
[17] active metabolite desmethylclobazam
[18] duration of pharmacological effects: 0.3–0.4 h; major metabolite: benzoylecgonine ($t_{1/2}$: 5–6 h)
[19] active metabolites nordazepam and oxazepam (see Table)
[20] active metabolite nordothiepin ($t_{1/2}$: 20–60 h)
[21] active metabolite desmethyldoxepin (nordoxepin, $t_{1/2}$: 33–80 h) should be considered in case of intoxication
[22] benzodiazepineantagonist
[23] active metabolites
[24] active metabolite desalkylflurazepam ($t_{1/2}$: 74 ± 24 h)
[25] active metabolite nortilidine ($t_{1/2}$: 6 h), comatose-fatal plasma concentration: 4.4 μg/ml[8]
[26] in some cases up to 80 h
[27] active metabolite levomepromazine sulfoxide ($t_{½}$: 5–10 h)
[28] $t_{1/2}$ for biological effects
[29] active metabolite desipramine (see Table)
[30] active metabolites diazepam, nordazepam plus oxazepam (see Table)
[31] active metabolite of mesuximide
[32] sum of active metabolites
[33] each as desacetylmetipranolol
[34] active metabolite 5-aminosalicylic acid (mesalazine, see Table); rapid/slow acetylators of the primary metabolite sulfapyridine
[35] in some cases longer
[36] active metabolite oxyphenbutazone ($t_{½}$: 27–64 h)
[37] dose dependent
[38] active metabolite of procainamide
[39] for the management of osteoporosis
[40] active metabolite nortetrazepam ($t_{1/2}$: 25–51 h)
[41] smokers: 3–6 h
[42] during steady state
[43] astemizole plus desmethylastemizole
[44] blood drug concentrations following therapeutically effective doses below detection limit
[45] as decanoate ($t_{1/2}$: 5–12 days)
[46] in intensive care patients in some cases 8–22 h
[47] physiologic
[48] rapid (extensive) and slow (poor) metabolizers (genetic polymorphism)
[49] 6 month-old-child, appr. 15 h after 100 mg rectally tramadol
[50] total labetalol: 0.7–5.0 μg/ml
[51] C_{max} 0.038 ± 0.006 μg/ml after a single oral dose of 150 μg/kg in nine persons with onchocerciasis ($t_{1/2}$: 56 ± 7 h)
[52] as enalaprilat
[53] duration of clinical effect: 3–5 h
[54] product after hydrolysis
[55] narcotic; analyzed during distribution phase
[56] for pneumocystis carinii pneumonia (PcP) treatment: sulfamethoxazole 100–200 μg/ml, trimethoprim 5–10 μg/ml
[57] metabolite: pentobarbital (see Table)
[58] "narcotic"
[59] higher with meningism (–25 μg/ml); decreased protein binding in neonates results in increased unbound drug
[60] each as 2-hydroxyflutamide (active and major metabolite)
[61] active metabolite of allopurinol
[62] active metabolite paracetamol (acetaminophen, see Table)
[63] active metabolite phenobarbital (see Table)
[64] as active carboxylic acid metabolite = fexofenadine ($t_{1/2}$: mean 15 h)
[65] 1 mg oral alprazolam/day equals appr. a plasma concentration of 10 ng alprazolam/ml during steady state. Usually higher doses/plasma concentrations are recommended for the treatment of phobias when compared to panic disorder/attacks
[66] highly inter- and intraindividual variable kinetics; for children (therapeutically): 0.04–0.1 μg/ml; active metabolite desmethylchlorpromazine
[67] ≥0.25 μmol/l desirable for echinococcosis
[68] mean: 27 h; for geriatric patients (>65 years) in some cases increased to more than 90 h
[69] active metabolite 2-hydroxydesipramine ($t_{1/2}$: mean 18 h; in patients with impaired renal function several fold increased)
[70] in patients with impaired renal function several fold increased
[71] in colon tissue 0.8–1.8 h after 1 × 2 g i.v.: 94.0–7.4 μg/g
[72] active metabolites 1-(5-hydroxyhexyl)-3,7-dimethylxanthine and 1-(3-carboxypropyl)-3,7-dimethylxanthine ($t_{1/2}$: 1–1.6 h), among others, with 5 and 8 times, respectively, higher plasma levels than pentoxifylline
[73] as canrenone (one of the active metabolites of spironolactone, $t_{1/2}$: 1.31.4 h)

[74] appr. 8 h after ingestion of probably 210 mg haloperidol and 1400 mg orphenadrine-HCl with life-threatening arrhythmias
[75] data on effective plasma concentrations for Parkinson's disease not available
[76] peak: 20–30 μg/ml, trough: <7 μg/ml
[77] for hypertension: 0.2–0.45 μg/ml; for angina/CHD, arrhythmias: 0.3–0.8 μg/ml
[78] therapeutic concentration of the unbound fraction: appr. 0.5–2 μg/ml
[79] in mmol/l (mEq/l, mval/l): 0.4–1.2 (0.6–1.4), toxic from 1.5
[80] terminal elimination $t_{1/2}$: 37 ± 6 h; increased in case of renal dysfunction
[81] therapeutic concentration of the unbound fraction: 1–2.2 μg/ml
[82] for (sleep) apnea: 5–10 μg/ml
[83] increased in patients with impaired renal function
[84] C_{max} 3–5 h after 4 mg oral loperamide hydrochloride: 1–3 ng/ml
[85] active metabolite N-desmethylclomipramine ($t_{1/2}$: 21–65 h, mean: 40 h)
[86] 12–36 h
[87] post-operative (on-demand; i.v.): 0.02–1–2 μg/ml (median: 0.29–0.92 μg/ml) as minimal (analgesic) effective concentration; O-desmethyltramadol: 0.03–0.04 μg/ml (median: 0.036 μg/ml)
[88] 10–36 h
[89] 11–26 h
[90] stereoselective metabolism (therapeutic concentration after oral application higher than after intravenous administration)
[91] $t_{1/2}$ for ß-phase: 0.5–1 h
[92] as albendazole sulfoxide (active metabolite)
[93] $t_{½}$ in slow (poor) metabolizers appr. 40 h
[94] through plasma concentration at steady state during 2 g twice daily p.o. appr. 9 μg/ml; C_{max} 0.8 h after 1 g orally: appr. 45 μg/ml
[95] as active metabolite methimazole
[96] mean 80 min
[97] 15–85 h
[98] plasma concentrations does not correspond with pharmacological effects
[99] plasma concentrations of the less potent major metabolite 6-β-naltrexol ($t_{1/2}$: 11–13 h) are usually 1.5–10 times higher
[100] appr. 25–30 h for the metabolites
[101] sum rifampicin plus metabolites
[102] sum sulindac plus metabolites (sulindac sulfide, $t_{1/2}$: 15–18 h; $t_{1/2}$ sulfone: 17–20 h)
[103] abuse
[104] sum carisoprodol plus meprobamate
[105] 12–15 days for the metabolites
[106] $t_{1/2}$ for total platinum plasma concentrations: 20–40 h (up to 6–7 days)
[107] 2–20 μmol/l
[108] carboxylic acid metabolite ($t_{1/2}$: appr. 20 days): 1.5–5.5 μg/ml
[109] during concomitant therapy with carbamazepine or phenytoin 8–33 h (mean: 15 h), during concomitant therapy with valproic acid 31–89 h (mean: 60 h)
[110] in infants and after intoxications in some cases dramatically increased
[111] during steady state 3–4 h after oral doses of 100–400 mg; prophylaxis of candidiasis: >0.2 μg/ml and of aspergillosis: >1.0 μg/ml in patients with acute myeloid leukemia (AML)
[112] plasma concentrations of the major metabolite 13-cis-acitretin are usually higher
[113] higher and increased, respectively, in patients with impaired hepatic function; for tinnitus aurium: therapeutic plasma concentration appr. 1–2 μg/ml
[114] biologically active/major metabolite cycloguanil ($t_{1/2}$: 8–17 h): plasma concentration level after daily oral doses of 100–200 mg proguanil appr. 0.02–0.06 μg/ml
[115] active metabolite norpethidine ($t_{1/2}$: 14–24 (–48) h): toxic from appr. 0.5 μg/ml
[116] tremor, hypokalemia
[117] as cytostatic drug: >200 μg/ml
[118] neurotoxic
[119] in terminal renal insufficiency appr. 0.5–2 μg/ml, cumulation of the inactive metabolite N-acetyl-5-aminosalicylic acid (Ac-5-ASA) up to 20 μg/ml without adverse effects
[120] $t_{1/2}$ of the inactive major metabolite N-acetyl-5-aminosalicylic acid (Ac-5-ASA) appr. 6–9 h
[121] tocolytic (4.5–6.25 mval(mEq)/l, 2.25–3.125 mmol/l). Approximate normal range: 18–25 μg Mg^{2+}/ml (0.74–1.03 mmol/l); conversion factor: mg/dl × 0.4113 = mmol/l
[122] C_{max} appr. 2–8 μmol/l (i.e. 1.7–6.8 μg/ml, after 170–275 mg/m^2 intravenously for 6 h); much lower after intraperitoneal injection
[123] as transdermal system (patch); plasma concentrations of the major metabolite cotinine ($t_{1/2}$: mean 16–20 h) appr. 10 times higher
[124] mean 2 h; after application of the transdermal system possibly longer
[125] active metabolites desipramine (see Table), 2-hydroxyimipramine ($t_{1/2}$: 6–18 h), and 2-hydroxydesipramine[69]
[126] 3–7 min after retrobulbar blockade: 0.5–1.1 μg/ml
[127] for myasthenia gravis
[128] EC_{50} analgesia; EC_{50} respiratory depression: 0.035 ± 0.022 μg/ml
[129] appr. 14 h after oral ingestion of 1.5 g
[130] $t_{1/2}$ of the active metabolite norfluoxetine: 7–9 days (mean)
[131] active metabolites 2-oxoquazepam ($t_{1/2}$: 39 (28–43) h) and N-desalkyl-2-oxoquazepam (N-desalkylflurazepam, $t_{1/2}$: 74 ± 24 h)
[132] peak plasma concentration during steady state (C^{ss}_{max})
[133] range of plasma concentrations after therapeutically effective doses of thioridazine for the active metabolites mesoridazine (thioridazine-2-sulfoxide): 0.2–1.6 μg/ml ($t_{1/2}$: 10–14 h) and sulforidazine (thioridazine-2-sulfone): up to 0.6 μg/ml ($t_{1/2}$: 10–16 h) and for the inactive metabolite thioridazine-5(ring)-sulfoxide: 0.06–4 μg/ml; probably, the best correlation exists between the plasma concentration of mesoridazine and the clinical response
[134] usually sleep occurred with ≥0.1 μg/ml; in infants and children (<13 years): in some cases during mechanical ventilation up to 3 μg/ml; α-hydroxymidazolam-glucuronide likely contributes in case of impaired renal function to prolonged sedation
[135] plasma concentration range of the primary metabolite 1,5-dimethyl-3,3-diphenyl-2-ethylidene-pyrrolidine during steady state: 0.005–0.055 μg/ml (daily oral methadone dose: 10–225 mg, mean 60 mg)
[136] ratio clozapine/active metabolite N-desmethylclozapine (norclozapine, $t_{1/2}$: 19.2 ± 10.2 h) usually 1.0 to 2.5
[137] maximum antiemetic effect at >0.01 μg/ml
[138] active metabolite descarboethoxyloratadine ($t_{1/2}$: 17–24 h): appr. 0.005–0.02 μg/ml
[139] 0.15 ± 0.05‰ per h
[140] during chronic administration appr. 10–20 h (induction of own metabolism)
[141] caution is warranted in case of concomitant use or intoxication with serotonin reuptake inhibitors (SSRI) as citalopram, clomipramine (fluoxetine, paroxetine): possible serotonin syndrome
[142] trough concentration; peak concentration: <40 μg/ml
[143] distribution half-life: 0.3–0.5 (–1) h
[144] non-smoker: 1–4 μg/ml (17–69 μmol/l);
smoker: 3–12 μg/ml (52–206 μmol/l)
[145] major active metabolite 1-m-chlorophenylpiperazine; plasma concentration appr. 1/10 compared to trazodone
[146] plasma concentration for maximal cellular accumulation of the active form gemcitabine-5′-triphosphate
[147] after topical nasal or ocular administration
[148] Torsade de pointes, usually due to cytochrome P450 3A4 inhibition (e.g., ketoconazole, erythromycin) and/or impaired hepatic function
[149] after oral administration; after topical application: plasma concentration < 0.03 μg/ml and $t_{1/2}$ appr. 22 h
[150] for each added 1 mg/day dose of clonazepam, there is appr. an increase of 12 ng/ml in the plasma (patients with panic disorder)
[151] sum amoxapine and major metabolite 8-hydroxyamoxapine ($t_{1/2}$: appr. 30 h; $t_{1/2}$ 7-hydroxyamoxapine: 4–6.5 h)
[152] sum bupropion (amfebutamone) and morpholinole metabolite ($t_{1/2}$: 19–22 h)
[153] after i.m.-application as decanoate appr. 3 weeks
[154] C_{min} <1–2 μg/ml at best (especially in patients with renal dysfunction)
[155] appr. 0.02 μg/ml in organophosphorous ester poisoning depending on the clinical symptoms
[156] in case of organophosphorous ester (e.g. parathione) intoxication; 250 mg intravenously as bolus followed by an infusion of 750 mg/24 h
[157] if used as an antiarrhythmic appr. 0.1–0.4 μg/ml
[158] using daily oral doses of ≤25 mg 0.00046 μg risperidone/ml per mg dose and 0.0064 μg/ml per mg dose for risperidone plus 9-hydroxyrisperidone (the clinical effects likely results from the combined concentrations)
[159] extensive metabolizers; $t_{½}$ for risperidone plus 9-hydroxyrisperidone: 22–24 h
[160] 6 case reports: post-mortem 5.2–49 μg citalopram/g blood and 0.3–1.4 μg desmethylcitalopram/g blood
[161] concentration/dose-values for extensive metabolizers: 0.025–0.55 (median 0.098) nmol/l per mg oral perphenazine, and 0.096–0.75 (median 0.195) nmol/l per mg oral perphenazine (mol wt 506.07) for poor metabolizers, respectively
[162] two cases after ingestion of appr. 4 g moclobemide in combination with clomipramine (plasma concentration: 0.3–0.5 μg/ml, i.e. toxic)
[163] as R-enantiomer, mean: 9 μg/ml
[164] dosage: 50–55 mg/kg per day
[165] appr. 2.5 h after ingestion of 50–100 mg amlodipine besylate with alcohol (263 mmol ethanol/l)
[166] 101 ng/ml 4 h after ingestion of 70 mg and 185 ng/ml at 10.5 h, complicated by oxazepam ingestion
[167] data for d,l-sotalol
[168] after i.v.-application; $t_{1/2}$: 4–7 h following epidural administration (appr. 4–5 h following intercostal block and appr. 8 h following brachial plexus blockade, respectively)
[169] mean 19 h; $t_{1/2}$ of oral cyclosporine microemulsion is appr. 8 h
[170] a longer $t_{1/2}$ has been reported in elderly patients, up to 3.8 days
[171] target range of activated partial thromboplastin time (aPTT) is prolongation of 50–70 sec, aPTT prolongation of more than 100 sec has been associated with an increased risk of hemorrhagic events

[172] as 10-hydroxycarbazepine for seizures; in patients with trigeminal neuralgia, therapeutic serum concentrations of the active metabolite 10-hydroxycarbazepine ($t_{1/2}$: 8–11 h): 50–110 μmol/l
[173] mild CNS symptoms (limited data)
[174] pharmacologically inactive metabolites 5′ and 6′-hydroxytenoxicam
[175] effective plasma concentrations for the 2 active metabolites: O-desmethylencainide (0.05–0.3; toxic from 0.3 μg/ml, $t_{1/2}$: 11 h) and 3-methoxy-o-desmethylencainide (0.06–0.28 μg/ml; $t_{1/2}$: >24 h) during long-term therapy
[176] in poor metabolizers 9–11 h
[177] "normal": 0.001–0.006; smoker: 0.005–0.012 (−0.15) μg/ml; μmol/l × 0.026 = μg/ml
[178] reference value; 0.001 μg/g creatinine or 0.0014 μg/ml urine; <30 μg/24 h urine ("normal"); "toxic" from appr. 0.05–0.3 μg/ml urine
[179] >0.04 μg/ml urine
[180] up to years in chronically exposed workers
[181] combination with 2,4-D and chlorpyrifos
[182] in case of intoxication/overdose: 70–90 h
[183] overdose
[184] one case of toxicokinetic estimation in acute KCN poisoning
[185] tentative target range; C^{ss}_{max} appr. 4.6 μg/ml (300 mg tid) and appr. 8.4 μg/ml (600 mg tid)
[186] prolonged in case of impaired renal function to 16–43 h; >100 h in dialysis dependent patients
[187] dependent of urine pH, if alkaline appr. 8–10 h
[188] females showed significantly longer elimination half-lives (35.4 ± 13.7 h) than males (mean 21–26 h); the $t_{1/2}$ of the R(−)-enantiomer is twice that of the S(+)-enantiomer
[189] after doses of 25, 75, and 150 mg every 8 h for 3 days, mean peak serum levels were 0.053, 0.167, and 0.393 μg/ml; corresponding levels of the major active metabolite O-desmethylvenlafaxine ($t_{1/2}$: 10–11 h) were 0.148, 0.397, and 0.686 μg/ml
[190] at least 10 nmol of the lactone (mol wt 421.46)/l (?); decreases in absolute neutrophil counts of 50–90% were observed with steady state plasma concentrations of total topotecan (lactone + hydroxy acid) of 20–60 nmol/l, respectively
[191] a mean steady state peak plasma concentration of 0.286 μg/ml was observed in healthy volunteers after 60 mg (oral solution) every 12 hours for 10 doses
[192] the metabolite 2′,2′-difluorodeoxyuridine (dFdU) has minimal antitumor activity but may contribute to the toxicity of gemcitabine
[193] C_{max} after 200 mg tid
[194] serum concentration of benzoic acid following high dose diazepam i.v.-infusion and severe metabolic acidosis (5-year-old girl; urine concentration: 1200 μg/ml)
[195] 1.5 h in dogs after i.v.-administration
[196] for erythropoietic protoporphyria (EPP)
[197] trough; peak: 0.1–0.5 μg/ml
[198] +0.4 μg of its metabolite 3-deacetylpancuronium/ml
[199] "normal": ≤2–3% of total Hb; from 15–20%: cyanosis, headache, dizziness
[200] "normal": ≤5% (elderly: −15%); smoker: 8–10%
[201] 2 h after ingestion
[202] 3 h after ingestion of 400 mg with no severe symptoms
[203] mean steady state trough concentration; peak: 5–15 μg/ml
[204] for Parkinson's disease (appr. 15–50 pmol/ml)
[205] peak: 0.5–3 μg/ml
[206] plasma concentrations below detection limit; plasma concentrations of the active metabolite 6-methoxy-2-naphthylacetic acid ($t_{1/2}$: appr. 24 h), which appears to be responsible for the effects, were 10–37 μg/ml 3–6 h after single oral doses of 250, 500, and 1000 mg
[207] active metabolite 6-O-desmethyldonepezil
[208] coma in a patient overdosing zonisamide, carbamazepine, and clonazepam
[209] 25–30 h in patients co-medicated with enzyme-inducing anticonvulsants
[210] 2–4 h in patients co-medicated with enzyme-inducing anticonvulsants
[211] long-term (2–3 years) treated renal-transplant patients had significantly lower trough plasma concentrations of mycophenolic acid (1.94 ± 0.24 μg/ml), the active metabolite, compared with patients taking mycophenolate mofetil (1 g twice daily) short-term (2–10 months; 3.53 ± 0.45 μg/ml). Proposed mycophenolic acid pre-dose target concentration: 1–3.5 μg/ml
[212] as mycophenolic acid
[213] ten men with multiple sclerosis, 10–20 mg p.o. every 6 h 30 min before the next dose; peak levels <0.1 μg/ml 30 min after a dose
[214] nine patients, maximum tolerated oral dose 50–100 mg
[215] $t_{1/2}$ metabolite 3-O-methyldopa: 15 h
[216] appr. 2.5 μmol/l (1 μg/ml) 24 h after single doses of 100–800 mg and during daily treatment with 200 mg
[217] active metabolite 14-hydroxyclarithomycin ($t_{1/2}$: 5–7 h)
[218] C_{max} following oral administration of 200, 400, 800, and 1200 mg, respectively: 3.7, 8, 18, and 29 μg/ml
[219] at a daily dosage of 60, 120, and 240 mg the mean ± SD concentration in patients with symptomatic ventricular tachyarrhythmias (n = 9–18) was 75 ± 46, 144 ± 105, and 324 ± 180 nmol/l, respectively
[220] nonlinear kinetics
[221] appr. 5 h after ingestion of 3 g, not associated with severe toxicity to a 27-year-old woman
[222] slightly increased (8–12 h) in patients with impaired hepatic function; active metabolites hydroxynefazodone ($t_{1/2}$: 2–5 h), m-chlorophenyl-piperazine ($t_{1/2}$: 4–10 h), and triazoledione ($t_{1/2}$: 10–12 h)
[223] each as N-desmethylsuximide; appr. methsuximide ($t_{1/2}$: 1–2 h) steady state concentration: 0.04–0.08 μg/ml
[224] mean steady state trough concentration in 15 young adults receiving a daily dose of 0.47–1.71 mg isotretinoin/kg: 0.05–0.34 μg/ml ($t_{1/2}$: 29 ± 40 h), and for the 4-oxo metabolite ($t_{1/2}$: 22 ± 10 h): 0.16–0.68 μg/ml
[225] for depression; higher in case of schizophrenia (2–3 μg/ml?)
[226] suggested threshold for the sum of clomipramine (0.05–0.06 μg/ml) and N-desmethylclomipramine (0.16–0.18 μg/ml): 0.2–0.24 μg/ml
[227] for the active metabolite E-3174 ($t_{1/2}$: 4–9 h); plasma concentration of losartan producing 50% of maximal blood pressure response to exogenous angiotensin-II: 0.032 μg/ml
[228] as ramiprilat ($t_{½}$: 13–17 (50–110) h)
[229] IC_{50} level for analgesic effect after oral surgery
[230] the inhibitory concentration to reduce the level of extracellular hepatitis B DNA by 50% varied from 2.3 ng/ml to 1.3 μg/ml
[231] C_{max} at steady state (666 mg tid p.o.)
[232] after oral administration of the enteric-coated tablet
[233] trough <2 plus peak 6–10 (5–12) μg/ml
[234] reference value; <0.015 μg/ml urine
[235] active metabolite 4′-hydroxynimesulide ($t_{½}$: 3–9 h)
[236] C_{max} 126.5 and 226.3 ng/ml (at 2 h) after 75 and 125 mg p.o.
[237] in patients >60 years prolonged up to 10 h
[238] adjuvant in methadone maintenance therapy
[239] means of the 'average' steady state plasma concentration for the relatively high dose of 250 mg q8 h appr. 0.4–0.6 μg/ml
[240] combination of distribution and elimination processes
[241] as active metabolite fenofibric acid
[242] appr. 37.5 mmol/l (mval/l, mEq/l)
[243] steady state concentration 21.6 ± 14.2 μg/ml (mean ± SD) during continuous infusion of 3 g (1.1–2.2 mg/kg h) every 24 hours in 44 patients undergoing coronary artery bypass graft surgery
[244] target trough concentration if cyclosporine (CsA) is being used at trough concentrations of 0.075–0.15 μg/ml; without CsA: appr. 0.03 μg/ml (LC/UV assay)
[245] 4 hours after ingestion of 30–40 tiagabine HCl 8 mg tablets (coma)
[246] bupropion plus 10-hydroxybupropion
[247] calculated steady state concentration in children (4 months to 16 years) receiving 0.3 mg/kg b.w. i.v.
[248] femoral blood concentration of the metabolite desmethylalimemazine after fatal intoxication: 0.2–1.3 μg/g
[249] 40–50 min after 0.15 mg/kg i.v.
[250] femoral blood concentration of the metabolite desmethylpromethazine after fatal intoxication (n = 3): 0.3–1.8 μg/g
[251] femoral blood concentration of the metabolite desmethyltrimipramine after fatal intoxication (n = 10): 0.3–2.5 μg/g
[252] fatal overdose with tramadol, alprazolam (0.21 μg/ml), and alcohol (1.29 g/kg) in a 30-year-old woman
[253] enterohepatic circulation; prolonged in elderly subjects to 33.4 hours (range: 20.0–53.4 h)
[254] C_{min}/D [(ng/ml)/mg], i.e. dose-normalised trough plasma drug concentration, dosage interval 8 h
[255] all data refer to the active metabolite A771726
[256] steady state concentrations at 5, 10, and 25 mg/d, respectively
[257] steady state trough concentrations after 400 mg/d orally; two major metabolites modafinil acid (appr. 0.5–0.8 μg/ml, $t_{½}$: 7.3 ± 1.1 h) and modafinil sulfone (appr. 4.5–5.3 μg/ml), but neither appears to contribute to the wake-promoting properties of modafinil
[258] mean plasma trough concentration at steady state obtained from 400 mg imatinib/day in 83 adult patients with chronic phase CML; peak: 2.3 μg/ml
[259] in a 5-year-old girl
[260] at this time (March 2003), there is insufficient evidence to recommend a general therapeutic range
[261] active metabolite N-desethylamiodarone ($t_{1/2}$: 57–64 days), which achieves plasma concentrations similar to the parent compound
[262] inactive metabolites deshydroxyethyl opipramol ($t_{1/2}$: 97 ± 24 h) and opipramol N-oxide ($t_{1/2}$: 10.7 ± 3.2 h)
[263] as 25-hydroxyvitamin D for adults >49 years
[264] 6 h after reportedly ingestion of 30 g in a 38-year-old woman
[265] metabolite perindoprilat, 3 to 10 hours, with a prolonged terminal half-life between 25 to 120 h
[266] sum venlafaxine and O-desmethylvenlafaxine
[267] for glaucoma 4–5 μg/ml
[268] doxapram + keto-doxapram
[269] 24 h after ingestion of appr. 20 ml
[270] active metabolite desethylamodiaquine ($t_{1/2}$: 1–10 days)
[271] smokers: −0.0006 μg/ml

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Winek's Drug & Chemical Blood-Level Data 2001

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We have gathered the data in the table from the literature and from personal experience. The values are not considered absolute, but are to be used as a guide in evaluating a given case. The values can be affected by dose, route of administration, absorption differences, age and sex, tolerance, method of analysis, pathological or disease state, postmortem redistribution, etc. Users of the table are referred to *Winek's Toxicology Annual* and Chapter 72 in *Forensic Medicine,* Volume III, by Tedeschi, Eckert and Tedeschi for chapters discussing the data, reference to the data, and factors affecting blood-level values. For additional pharmacokinetic information and other tissue levels, users are referred to Baselt's reference, *Disposition of Toxic Drugs and Chemicals in Man.*

Users are cautioned against pharmacists using pharmacokinetics for interpretation of blood-level data when death is involved. It should be obvious that kinetics, even pharmacokinetics, are not applicable to the moribund state.

Definition of Blood Levels

Therapeutic Blood Level

Winek defines a therapeutic blood level as that concentration of drug and/or its active metabolite(s) present in the blood (serum or plasma) following therapeutically effective dosage in humans.

Toxic Blood Level

The concentration of drug and/or its active metabolite(s) or chemical present in the blood (serum or plasma) that is associated with serious toxic symptoms in humans.

Lethal Blood Level

The concentration of drug and/or its active metabolite(s) or chemical present in the blood (serum or plasma) that has been reported to cause death, or is so far above reported therapeutic or toxic concentrations, that one can judge that it might cause death in humans.

Normal Blood Level

Some of the values under normal represent normal body constituents and others represent values related to normal environmental exposure. Values can, and do, vary with geographical location.

Suggested additions or corrections can be made by contacting the author at drwinek@aol.com. Recommendations are always welcomed.

Units

Drugs and chemicals in the table are reported in both mg% and μg/mL. Drugs are listed by both their trade and generic names. Mg% (milligram percent) is equal to mg/dL (milligram/deciliter); μg/mL (microgram/milliliter) is equal to mg/L (milligram/liter).

NOTE:

Divide the mg% level by 100 to obtain mg/mL Divide the μg% level by 100 to obtain μg/mL. To convert mg/L or μg/L to mg% or μg%, divide level by 10.

Examples:

1mg/L = 0.1mg%

3μg/L = 0.3μg%

μg is the representation for microgram (mcg).

Many therapeutic drugs are reported in nanograms/milliliter (ng/mL). To convert the listed mcg/mL in this table to ng/mL, multiply the listed value by 1000. For example, digoxin concentration of 0.0022 mcg/mL would be 0.0022 x 1000 = 2.2 ng/mL. Put simply, you move the decimal point three places to the right.

Dr. Charles L. Winek

Dr. Winek is a professor of toxicology at Duquesne University School of Pharmacy and also teaches for the University's School of Education, Graduate School of Arts and Sciences, and the Law School. He is a diplomate of both American Board of Forensic Toxicology and the Academy of Toxicological Sciences.

Dr. Winek is currently the director of Pittsburgh Criminalistics Laboratory and is the former chief toxicologist for the Allegheny County Coroner's Office, positions he held for 32 years. He continues to testify frequently as an expert witness in both criminal and civil cases in Allegheny County and throughout the United States.

Dr. Winek has published 119 articles in scientific journals and authored, co-authored or contributed to 29 books.

Additionally, Dr. Winek is toxicology editor for the scientific journal *Forensic Science International* and a member of the editorial boards of *The Journal of Applied Toxicology* and the journal *Analytical Toxicology.*

(**NOTE:** *Winek's Drug & Chemical Blood-Level Data 2000* is reprinted with written permission as a courtesy to our customers. Fisher HealthCare accepts no responsibility for the accuracy of its contents.)

Drug and Chemical Blood Level Data - 2001

DRUG	Therapeutic or Normal		Toxic		Lethal	
	mg%	ug/ml	mg%	ug/ml	mg%	ug/ml
A						
Acebutolol (Spectral)	0.05 - 0.12	0.5 - 1.2	*****	*****	*****	*****
Acetaminophen (Tylenol)	1 - 2	10 - 20	15	150	>16	>160
Acetazolamide (Diamox)	1.0 - 1.5	10 - 15	*****	*****	*****	*****
Acetohexamide (Dymelor)	2.1 - 5.6	21 - 56	*****	*****	*****	*****
Acetone	*****	*****	20 - 30	200 - 300	55	550
Acetonitrile [met: to Cyanide]	*****	*****	*****	*****	0.077	0.77
Acetylsalicylic Acid [as met:	2 - 10	20 - 100	15 - 30	150 - 300	50	500
Salicylate-for analgesic use]						
Acetylsalicylic Acid [as met:	2 - 25	20 - 250	*****	*****	*****	*****
Salicylate-for rheumatoid arthritis]						
Actidil (Triprolidine)	0.0004 - 0.0044	0.004 - 0.044	*****	*****	*****	*****
Actifed (Pseudoephedrine)	0.050 - 0.077	0.50 - 0.77	*****	*****	1.9	19
(Triprolidine)	0.0004 - 0.0044	0.004 - 0.044	*****	*****	*****	*****
Actron (Ketoprofen)	0.5 - 0.15	5 - 1.5	*****	*****	*****	*****
Adalat (Nifedipine, Procardia)	0.0015 - 0.0162	0.015 - 0.162	*****	*****	*****	*****
Alcaine (Proparacaine)	*****	*****	*****	*****	1.5	15
Aldrin	0.00015	0.0015	0.00035	0.0035	*****	*****
Alfenta (Alfentanil)	0.010 - 0.12	0.10 - 1.2	*****	*****	*****	*****
Alfentanil (Alfenta)	0.010 - 0.12	0.10 - 1.2	*****	*****	*****	*****
Allegra (Fexofenadine)	0.018 - 0.021	0.18 - 0.210	*****	*****	*****	*****
Alphaprodine (Nisentil)	0.087 - 0.100	0.87 - 1.00	*****	*****	0.33	3.3
Alprazolam (Xanax)	0.0025 - 0.0102	0.025 - 0.102	*****	*****	0.0122 - 0.039	0.122 - 0.39
Aluminum	0.013	0.13	*****	*****	*****	*****
Amantadine (Symmetrel)	0.006 - 0.031	0.06 - 0.31	0.1 - 0.05	1 - 0.5	0.21 - 0.48	2.1 - 4.8
Ambien (Zolpidem)	0.0029 - 0.0272	0.029 - 0.272	*****	*****	0.05 - 0.112	0.5 - 1.12
Aminophylline (Theophylline)	1 - 2	10 - 20	3 - 4	30 - 40	5 - 25	50 - 250
Amitriptyline (Elavil)	0.012 - 0.025	0.12 - 0.25	>0.05	>0.5	0.2 - 2.0	2 - 20
Amitriptyline (Elavil)	0.012 - 0.025	0.12 - 0.25	>0.05	>0.5	*****	*****
[+met: Nortriptyline]						
Ammonia	0.05 - 0.17	0.5 - 1.7	*****	*****	*****	*****
Amobarbital (Amytal)	0.1 - 0.5	1 - 5	1 - 3	10 - 30	1.3 - 9.6	13 - 96
Amoxapine (Asendin)	0.0017 - 0.021	0.017 - 0.21	*****	*****	0.295 - 2.0	2.95 - 20
Amoxapine (Asendin)	0.02 - 0.04	0.2 - 0.4	*****	*****	*****	*****
[+met: 8-OH-amoxapine]						
Amphetamine	0.003 - 0.011	0.03 - 0.11	>0.05	>0.5	>0.1	>1
Amytal (Amobarbital)	0.1 - 0.5	1 - 5	1 - 3	10 - 30	1.3 - 9.6	13 - 96
Anafranil (Clomipramine)	0.01 - 0.045	0.1 - 0.45	*****	*****	*****	*****
Anaprox (Naproxen)	3.1 - 12	31 - 120	40	400	*****	*****
Analeridine (Leritine)	<0.05	<0.5	*****	*****	0.09 - 0.70	0.9 - 7.0
Aniline	*****	*****	*****	*****	0.63	6.3
Ansaid (Flubiprofen)	1 - 2.2	10 - 22	*****	*****	*****	*****
Antabuse (Disulfiram)	0.038 - 0.25	0.38 - 2.5	*****	*****	37 - 58	370 - 580
Antipyrine	0.5 - 2.5	5-25	*****	*****	11	110
Aralen (Chloroquine)	0.002 - 0.040	0.02 - 0.40	*****	*****	0.3 - 9.9	3 - 99
Arsenic	0.002 - 0.0062	0.02 - 0.062	0.1	1	0.9 - 1.5	9 - 15
Asendin (Amoxapine)	0.0017 - 0.021	0.017 - 0.21	*****	*****	0.295 - 2.0	2.95 - 20

Drug and Chemical Blood Level Data - 2001

DRUG	Therapeutic or Normal		Toxic		Lethal	
	mg%	ug/ml	mg%	ug/ml	mg%	ug/ml
Asendin (Amoxapine)	0.02 - 0.04	0.2 - 0.4	*****	*****	*****	*****
[+met: 8-OH-amoxapine]						
Astemizole (Hismanal)	0.00004	0.0004				
Atarax (Hydroxyzine, Vistaril)	0.0022 - 0.008	0.022 - 0.08	*****	*****	0.4 -3.9	4.2 - 39
Atenolol (Tenorim)	0.02 - 0.07	0.20 - 0.70	3.5	35	*****	*****
Ativan (Lorazepam)	0.001 - 0.024	0.01 - 0.24	0.03 - 0.06	0.3 - 0.6	*****	*****
Atromid (Clofibrate)	12.2	122	*****	*****	*****	*****
Atropine	0.0035 - 0.0200	0.035 - 0.200	*****	*****	0.02	0.2
Avelox (Moxifluxacin)	0.45 - 1.44	4.5 - 14.4	*****	*****	*****	*****
Aventyl (Nortriptyline)	0.005 - 0.0375	0.05 - 0.375	0.05	0.5	1.3	13
[met: Amitriptyline (Elavil)]						
AZT (Retrovir, Zidovadine)	0.027 - 0.08	0.27 - 0.8	*****	*****	*****	*****
B						
Baclofen (Lioresal)	0.01 - 0.06	0.1- 0.6	0.11 - 0.35	1.1 - 3.5	*****	*****
Barbital	1 - 2.6	10 - 26	6 - 8	60 - 80	>10	>100
Barbiturates (intermediate acting)	0.1 - 0.5	1 - 5	1 - 3	10 - 30	>3	>30
Barbiturates (long acting)	1 - 4	10 - 40	4 - 6	40 - 60	>8	>80
Barbiturates (short acting)	0.1	1	0.7	7	1	10
Benadryl (Diphenhydramine)	0.0025 - 0.0112	0.025 - 0.112	0.5	5	>0.8	>8
Benemid (Probenecid)	10 - 20	100 - 200	*****	*****	*****	*****
Bentyl (Dicyclomine)	0.002 - 0.008	0.02 - 0.08	*****	*****	*****	*****
Benzedrex (Propylhexedrine)	0.001	0.01	*****	*****	0.2 - 0.3	2 - 3
Benzene	*****	*****	>0	>0	0.090 - 0.12	0.90 - 1.2
Benzphetamine (Didrex)	0.0025 - 0.0500	0.025 - 0.500	>0.05	>0.5	1.4	14
Benztropine (Cogentin)	0.008 - 0.0126	0.08 - 0.126	0.0048	0.048	0.02 - 0.07	0.2 - 0.7
Bethanid (Bethanidine)	0.002 - 0.050	0.02 - 0.50	*****	*****	*****	*****
Bethanidine (Bethanid)	0.002 - 0.050	0.02 - 0.50	*****	*****	*****	*****
Bismuth	0.004 - 0.008	0.04 - 0.08				
Blocadren (Timolol)	0.004 - 0.023	0.04 - 0.23	*****	*****	*****	*****
Boron	0.08	0.8	4	40	5	50
Brethine (Terbutaline)	0.0002 - 0.0006	0.002 - 0.006	*****	*****	0.004	0.04
Brevibloc (Esmolol)	0.11 - 0.159	1.1 - 1.59	*****	*****	*****	*****
Bromide	0.30 - 23	3 - 230	50-150	500-1500	200	2000
Bromide [met: Carbromal (Carbital)]	0.6	6	40 - 125	400 - 1250	128.5 - 245.0	1285 - 2450
Bropheniramine (Dimetane)	0.0008 - 0.0015	0.008 - 0.015	*****	*****	*****	*****
Bupivacaine (Marcaine)	0.022 - 0.345	0.22 - 3.45	1	10	*****	*****
Buprenex (Buprenorphine)	0.0014 - 0.011	0.014 - 0.11	*****	*****	*****	*****
Buprenorphine (Buprenex)	0.0014 - 0.011	0.014 - 0.11	*****	*****	*****	*****
Bupropion (Wellbutrin)	0.0025 - 0.0100	0.025 - 0.100	*****	*****	0.73	7.3
Buspar (Buspirone)	0.0088 - 0.0147	0.088 - 0.147	*****	*****	*****	*****
Buspirone (Buspar)	0.0088 - 0.0147	0.088 - 0.147	*****	*****	0.73	7.3
Butabarbital (Butisol)	0.76 - 1.69	7.6 - 16.9	*****	*****	>3	>30
Butalbital (Sandoptal, Fioricet, Fiorinal)	0.17 - 0.26	1.7 - 2.6	0.7 - 4	7 - 40	1.3 - 2.6	13 - 26
Butanediol	*****	*****	*****	*****	28	280
Butaperazine (Repoise)	0.002 - 0.069	0.02 - 0.69	*****	*****	*****	*****
Butazolidin (Phenylbutazone)	1.6 - 15.0	16 - 150	20	200	40	400
Butisol (Butabarbital)	0.76 - 1.69	7.6 - 16.9	*****	*****	>3	>30

Drug and Chemical Blood Level Data - 2001

DRUG	Therapeutic or Normal		Toxic		Lethal	
	mg%	ug/ml	mg%	ug/ml	mg%	ug/ml
Butorphanol (Stadol)	0.00011-0.00017	0.0011 - 0.0017	*****	*****	*****	*****
Butyl Nitrite (Nitrite)	0.05 - 0.40	0.50 - 4	*****	*****	2.2	22
C						
Cadmium	0.00005-0.00040	0.0005 - 0.0040	0.005	0.05	0.11	1.1
Caffeine	0.2 - 1.0	2-10	*****	*****	>10	>100
Calan (Isoptin, Verapamil)	0.0055 - 0.0355	0.055 - 0.355	0.09	0.9	0.09 - 8.5	0.9 - 85
Captopril (Capoten)	0.051 - 0.131	0.51 - 1.31	*****	*****	2 - 6	20 - 60
Capoten (Captopril)	0.051 - 0.131	0.51 - 1.31	*****	*****	2 - 6	20 - 60
Carbamazepine (Tegretol)	0.14 - 1.2	1.4 - 12	>1.5	>15	>5	>50
Carbital (Carbromal) [as met: Bromide]	0.6	6	40 - 125	400 - 1250	128.5 - 245.0	1285 - 2450
Carbocaine (Mepivacaine)	0.028 - 0.550	0.28 - 5.50	1	10	5	50
Carbon Monoxide	1 - 2%	*****	15 - 35%	*****	48-95%	*****
[% Hemoglobin as Carboxyhemoglobin]						
Carbon Tetrachloride	*****	*****	2 - 5	20 - 50	10 - 20	100 - 200
Carbromal (Carbital) [as met: Bromide]	0.6	6	40 - 125	400 - 1250	128.5 - 245.0	1285 - 2450
Cardene (Nicardipine)	0.0036 - 0.015	0.036 - 0.150	*****	*****	*****	*****
Cardizem (Diltiazem)	0.005 - 0.04	0.05 - 0.40	0.37 - 0.61	3.7 - 6.1	0.67	6.7
Carisoprodol (Soma)	1 - 4	10 - 40	3 - 5	30 - 50	11	110
Cataflam (Voltaren, Diclofenac)	0.075 - 0.20	0.75 - 2.0	0.6	6	*****	*****
Catapres (Clonidine)	0.00003-0.00015	0.0003-0.0015	0.0006	0.006	0.023	0.23
Celexa (Citalopram)	0.0081 - 0.016	0.081 - 0.16	*****	*****	0.024 - 0.13	0.24 - 1.3
Celontin (Methsuximide)	1.0 - 4	10 - 40	4.4	>44	*****	*****
[as met: Desmethylmethsuximide]						
Centrax (Prazepam)	0.001 - 0.004	0.01 - 0.04	*****	*****	*****	*****
China White (Methylfentanyl)	*****	*****	*****	*****	0.0002 - 0.0011	0.002 - 0.011
Chlor-Trimeton (Chlorpheniramine)	0.0017	0.017	2 - 3	20 - 30	*****	*****
Chloral Hydrate (Noctec)	0.2 - 1.2	2 - 12	10	100	25	250
[as met: Trichloroethanol]						
Chloramphenicol (Chloromycetin)	1 - 2	10 - 20	*****	*****	20	200
Chlorcyclizine	0.005 - 0.010	0.05 - 0.10				
Chlormepramine	*****	*****	*****	*****	0.015 - 0.055	0.15 - 0.55
(plus metabolite - Norchlormepramine)						
Chlordane	0.0001	0.001	0.00025	0.0025	0.17 - 0.49	1.7 - 4.9
Chlordiazepoxide (Librium)	0.067 - 0.31	0.67 - 3.1	0.5	5	2	20
Chlormezanone (Trancopal)	0.25 - 0.88	2.5 - 8.8	*****	*****	*****	*****
Chloromycetin (Chloramphenicol)	1 - 2	10 - 20	*****	*****	20	200
Chloroform	2 - 50	20 - 500	7 - 25	70 - 250	39	390
Chlorophen (Chlorphentermine)	0.032	0.32	*****	*****	*****	*****
Chloroprocaine (Nesacaine)	0.2 - 0.4	2 - 4	*****	*****	*****	*****
Chloroquine (Aralen)	0.002 - 0.040	0.02 - 0.40	*****	*****	0.3 - 9.9	3 - 99
Chlorothiazide	0.6	6	*****	*****	*****	*****
Chlorpheniramine (Chlor-Trimeton)	0.001 - 0.0017	0.01 - 0.017	*****	*****	0.05 - 0.11	0.5 - 1.1
Chlorphentermine (Chlorophen)	0.032	0.32	*****	*****	*****	*****
Chlorpromazine (Thorazine)	0.001 - 0.050	0.01 - 0.50	0.1 - 0.2	1 - 2	0.3 - 1.2	3 - 12
Chlorpropamide (Diabenese)	3.0 - 36.3	30 - 363	20 - 75	200 - 750	*****	*****
Chlorprothixene (Taractan)	0.004 - 0.030	0.04 - 0.30	0.04 - 0.08	0.4 - 0.8	*****	*****
Chlor-Trimeton (Chlorpheniramine)	0.001 - 0.0017	0.01 - 0.017	*****	*****	0.05 - 0.11	0.5 - 1.1

Drug and Chemical Blood Level Data - 2001

DRUG	Therapeutic or Normal		Toxic		Lethal	
	mg%	ug/ml	mg%	ug/ml	mg%	ug/ml
Chlorthalidone (Combipress)	0.021 - 0.140	0.21 - 1.40	*****	*****	*****	*****
Cimetidine (Tagamet)	0.05 - 0.45	0.5 - 4.5	*****	*****	*****	*****
Citalopram (Celexa)	0.0081 - 0.016	0.081 - 0.16	*****	*****	0.024 - 0.13	0.24 - 1.3
Citanest (Prilocaine)	0.1 - 0.5	1 - 5	*****	*****	*****	*****
Claritin (Loratidine)	0.0007 - 0.0028	0.007 - 0.028	0.046	0.46	*****	*****
[metabolite: descarboethoxyloratadine]	0.0007 - 0.0028	0.007 - 0.028	0.046	0.46	*****	*****
Clinoril (Sulindac)	0.4 - 0.5	4 - 5	*****	*****	*****	*****
Clofibrate (Atromid)	12.2	122	*****	*****	*****	*****
Clomipramine (Anafranil)	0.01 - 0.045	0.1 - 0.45	*****	*****	*****	*****
Clonazepam (Klonopin)	0.0007 - 0.0075	0.007 - 0.075	*****	*****	*****	*****
Clonidine (Catepres)	0.00003-0.00015	0.0003-0.0015	0.0006	0.006	0.023	0.23
Clorazepate (Tranxene)	0.01 - 0.16	0.1 - 1.6	>0.5	>5.0	*****	*****
[as met: N-Desmethyldiazepam						
Clozapine (Clozaril)	0.0102 - 0.0771	0.102 - 0.771	*****	*****	*****	*****
Clozaril (Clozapine)	0.0102 - 0.0771	0.102 - 0.771	*****	*****	*****	*****
Cocaine	0.005 - 0.093	0.05 - 0.930	0.09	0.9	0.1 - 2.0	1 - 20
Codeine	0.003 - 0.034	0.03 - 0.34	*****	*****	>0.16	>1.6
Cogentin (Benztropine)	0.008 - 0.0126	0.08 - 0.126	0.0048	0.048	0.02 - 0.07	0.2 - 0.7
Colbenemid (Colchicine)	0.00003-0.00300	0.0003-0.0300	*****	*****	0.0021 - 0.025	0.021 - 0.25
Colchicine (Colbenemid)	0.00003-0.00300	0.0003-0.0300	*****	*****	0.0021 - 0.025	0.021 - 0.25
Combipress (Chlorthalidone)	0.021 - 0.140	0.21 - 1.40	*****	*****	*****	*****
Compazine (Prochlorperazine)	*****	*****	>0.1	>1	0.5	5
Copper	0.10 - 0.15	1.0 - 1.5	0.54	5.4	0.25 - 6.30	2.5 - 63.0
Coumadin (Warfarin)	0.10 - 0.31	1. 0 - 3.1	*****	*****	*****	*****
Cresol	*****	*****	*****	*****	0.90 - 1.90	9-19
Cyanide	0.0004 - 0.0041	0.004 - 0.041	*****	*****	0.11 - 5.3	1.1 - 53
Cylert (Pemoline)	0.07 - 0.62	0.70 - 6.2	*****	*****	*****	*****
Cyclizine	0.003 - 0.030	0.03 - 0.30	0.076	0.76	1.5	15
Cyclobenzaprine (Flexeril)	0.0015 - 0.0036	0.015 - 0.036	*****	*****	>0.04	>0.4
Cyclopropane	8 - 18	80 - 180	*****	*****	*****	*****
Cyclosporine (Sandimmune)	0.005 - 0.0045	0.05 - 0.045	*****	*****	*****	*****
D						
Dalmane (Flurazepam)	0.00005-0.00280	0.0005 - 0.0280	0.02	0.2	0.05 - 0.40	0.5 - 4.0
Dalmane (Flurazepam)	0.0033 - 0.0144	0.033 - 0.144	*****	*****	*****	*****
[+met: N-Desalkylflurazepam]						
Dantrium (Dantrolene)	0.1 - 0.3	1 - 3	*****	*****	*****	*****
Dantrolene (Dantrium)	0.1 - 0.3	1 - 3	*****	*****	*****	*****
Darvon (Propoxyphene)	0.023 - 0.107	0.23 - 1.07	0.03 - 0.06	0.3 - 0.6	0.1 - 1.7	1-17
Darvon (Propoxyphene)	0.104 - 0.371	1.04 - 3.71	0.28 - 1.2	2.8 - 12	0.27 - 4.7	2.7 - 47
[+ met: Norpropoxyphene]						
DDT	0.0013	0.013	*****	*****	*****	*****
Demerol (Meperidine)	0.007 - 0.080	0.07 - 0.80	0.5	5	0.8 - 2.0	8 - 20
Depakene (Valproic Acid)	5 - 10	50 - 100	0.71 - 20.0	7.1 - 200	*****	*****
Desipramine (Norpramin)	0.005 - 0.0684	0.05 - 0.684	>0.05	>0.5	1 - 2	10 - 20
[met: Imipramine (Tofranil)]						
Desmethylmethsuximide	1.6 - 4	16 - 40	4.4	>44	*****	*****
[met: Celontin (Methsuximide)]						

Drug and Chemical Blood Level Data - 2001

DRUG	Therapeutic or Normal		Toxic		Lethal	
	mg%	ug/ml	mg%	ug/ml	mg%	ug/ml
Desyrel (Trazodone)	0.07 - 0.489	0.7 - 4.89	*****	*****	1.5	15
Dextromethorphan	0.038	0.38	*****	*****	>0.3	>3
Diabenese (Chlorpropamide)	3.0 - 36.3	30 - 363	20 - 75	200 - 750	*****	*****
Diacetalol	0.063 - 0.433	0.63 - 4.33	*****	*****	*****	*****
Diamox (Acetazolamide)	1.0 - 1.5	10 - 15	*****	*****	*****	*****
Diazepam (Valium)	0.002 - 0.400	0.02 - 4.00	0.5 - 2.0	5 - 20	>3	>30
Diazepam (Valium)	0.031 - 0.600	0.31 - 6.00	*****	*****	>3.4	>34
[+ met: N-Desmethyldiazepam]						
Diazoxide (Hyperstat)	1.5 - 2.0	15 - 20	>10	>100	*****	*****
Diazinon	*****	*****	*****	*****	0.07 - 27.7	0.7 - 277
Dichloromethane (Methylene Chloride)	*****	*****	*****	*****	9.5 - 60	95 - 600
Diclofenac (Voltaren, Cataflam)	0.075 - 0.20	0.75 - 2.0	0.6	6	*****	*****
Dicumarol	0.8 - 5.9	8 - 59	7	70	*****	*****
Dicyclomine (Bentyl)	0.002 - 0.008	0.02 - 0.08	******	*****	*****	*****
Didrex (Benzphetamine)	0.0025 - 0.0500	0.025 - 0.500	>0.05	>0.5	1.4	14
Dieldrin	0.00015 - 0.002	0.0015 - 0.02	0.015 - 0.0303	0.15 - 0.303	0.05 - 0.116	0.5 - 1.16
Diethylpropion (Tenuate)	0.0007 - 0.0200	0.007 - 0.200	*****	*****	0.54	5.4
Difenoxin (Motofen)	0.016	0.160	*****	*****	*****	*****
Diflucan (Fluconazol)	0.5 - 1.5	5 - 15	*****	*****	*****	*****
Diflunisal (Dolobid)	0.9 - 13	9 - 130	*****	*****	37 - 58	370 - 580
Digoxin	0.00007-0.0022	0.0007 - 0.022	0.00030-0.00040	0.0030 - 0.0040	0.0035 - 0.02	0.035 - 0.20
Dihydrocodeinone (Hydrocodone)	0.003 - 0.025	0.03 - 0.25	0.05 - 0.2	0.5 - 2	0.07 - 1.2	0.7 - 12
Dilantin (Phenytoin, Diphenylhydantoin)	1 - 2	10 - 20	2 - 5	20 - 50	>10	>100
Dilaudid (Hydromorphone)	0.0008 - 0.0049	0.008 - 0.049	****	*****	0.03	0.3
Diltiazem (Cardizem)	0.005 - 0.04	0.05 - 0.40	0.37 - 0.61	3.7 - 6.1	0.67	6.7
Dimetane (Brompheniramine)	0.0008 - 0.0015	0.008 - 0.015	*****	*****	*****	*****
Dimethylsulfoxide (DMSO)	5.04 - 338	50.4 - 3380	*****	*****	160 - 300	1600 - 3000
Dimethyltryptamine	0.0001 - 0.0100	0.001 - 0.100	*****	*****	*****	*****
Dinitro-O-Cresol	*****	*****	3 - 6	30 - 60	7.5	75
Diphenhydramine (Benadryl)	0.0025 - 0.0112	0.025 - 0.112	0.5	5	>0.8	>8
Diphenoxylate (Lomotil)	0.001 - 0.004	0.01 - 0.04	*****	*****	*****	*****
Diphenylhydantoin (Phenytoin, Dilantin)	1 - 2	10 - 20	2 - 5	20 - 50	>10	>100
Diprivan (Propofol)	0.2 - 1.6	2 - 16	*****	*****	*****	*****
Disopyramide (Norpace)	0.2 - 0.6	2 - 6	0.7	7	2.6	26
Disulfiram (Antabuse)	0.038 - 0.25	0.38 - 2.5	*****	*****	37 - 58	370 - 580
Divinyl Oxide	*****	*****	*****	*****	70	700
DMSO (Dimethylsulfoxide)	5.04 - 338	50.4 - 3380	*****	*****	160 - 300	1600 - 3000
Dolobid (Diflunisal)	0.9 - 13	9 - 130	*****	*****	37 - 58	370 - 580
Dolophine (Methadone)	0.0075 - 0.110	0.075 - 1.10	0.02 - 0.2	0.20 - 2.0	0.04 - 0.18	0.4 - 1.8
Dopram (Doxapram)	0.27 - 0.52	2.7 - 5.2	*****	0.04 - 0.8	*****	*****
Doral (Quazepam)	1.1 - 14.8	11 - 148	*****	*****	*****	*****
Doriden (Glutethimide)	0.2 - 1.2	2 - 12	1 - 8	10 - 80	3 - 10	30 - 100
Dothiepin (Prothiaden)	0.0017 - 0.0420	0.017 - 0.420	*****	*****	0.03 - 0.25	0.3 - 2.5
Doxapram (Dopram)	0.27 - 0.52	2.7 - 5.2	*****	*****	*****	*****
Doxepin (Sinequan)	0.010 - 0.025	0.10 - 0.25	0.012 - 0.43	0.12 - 4.3	0.2 - 2.6	2 -26
Doxepin (Sinequan)	0.010 - 0.025	0.10 - 0.25	>0.05	>0.5	0.8 - 3.5	8 - 35
[+met: N-Desmethyldoxepin						

Drug and Chemical Blood Level Data - 2001

DRUG	Therapeutic or Normal		Toxic		Lethal	
	mg%	ug/ml	mg%	ug/ml	mg%	ug/ml
Doxylamine (Unisom)	0.0069 - 0.0138	0.069 - 0.138	*****	*****	0.07 - 1.2	0.7 - 12
Duranest (Etidocaine)	0.05 - 0.15	0.5 - 1.5	*****	*****	*****	*****
Dymelor (Acetohexamide)	2.1 - 5.6	21 - 56	*****	*****	*****	*****
Dyphylline	0.65 - 1.43	6.5 - 14.3	3.6	36	*****	*****
E						
Effexor (Venlafaxine)	0.007 - 0.393	0.07 - 3.93	*****	*****	*****	*****
[met: O-Desmethylvenlafaxine]	0.0061 - 0.075	0.061 - 0.75	0.1 - 0.15	1 - 1.5	*****	*****
Elavil (Amitriptyline)	0.012 - 0.025	0.12 - 0.25	>0.05	>0.5	0.2 - 2.0	2 - 20
Elavil (Amitriptyline)	0.012 - 0.025	0.12 - 0.25	>0.05	>0.5	0.2 - 2.0	2 - 20
[+met: Nortriptyline]						
Eldepryl (Selegiline)	0.0009 - 0.0019	0.009 - 0.019	*****	*****	*****	*****
Emetine	0.005 - 0.0075	0.05 - 0.075	*****	*****	0.24	2.4
Enalapril (Vasotec)	0.0063 - 0.007	0.063 - 0.070	*****	*****	*****	*****
Encainide (Enkaid)	0.01 - 0.03	0.1 - 0.3	*****	*****	*****	*****
{as met: O-Demethylencainide]						
Encainide (Enkaid)	0.006 - 0.028	0.06 - 0.28	*****	*****	*****	*****
[as met: Methoxy-O-demethylencainide						
Endrin	0.0003	0.003	0.0007 - 0.0032	0.007 - 0.032	0.045	0.45
Ephedrine	0.0068 - 0.01	0.068 - 0.10	*****	*****	0.35 - 2.1	3.5 - 21
Estazolam (Prosom)	0.0042 - 0.0100	0.042 - 0.100	0.125	1.25	*****	*****
Ethanol (listed toxic concentration is legal	*****	*****	80 - 100	800 - 1000	>350	>3500
intoxication for driving in most states)						
Ethchlorvynol (Placidyl)	0.05 - 0.88	0.5 - 8.8	*****	*****	2.2 - 21.3	22 - 213
Ethinamate (Valmid)	0.4 - 1.1	4 - 11	*****	*****	10 - 20	100 - 200
Ethosuximide (Zarontin)	4 - 10	40 - 100	*****	*****	25	250
Ethyl Chloride	20 - 30	200 - 300	*****	*****	40	400
Ethyl Ether	90 - 100	900 - 1000	*****	*****	140 - 189	1400 - 1890
Ethylene Glycol	*****	*****	150.0	1500.0	200 - 400	2000 - 4000
Etidocaine (Duranest)	0.05 - 0.15	0.5 - 1.5	*****	*****	*****	*****
Etodolac (Lodine)	1.2 - 4.7	12 - 47	*****	*****	*****	*****
F						
Famotidine (Pepcid)	0.0007 - 0.0035	0.007 - 0.035	*****	*****	*****	*****
Felbamate (Felbatol)	0.27 - 3.3	2.7 - 33	14 - 20	140 - 200	*****	*****
Felbatol (Felbamate)	0.27 - 3.3	2.7 - 33	14 - 20	140 - 200	*****	*****
Feldene (Piroxicam)	0.085 - 0.8	0.85 - 8.00	*****	*****	*****	*****
Felodipine (Plendil)	0.00015-0.00088	0.0015 - 0.0088	0.001 - 0.0015	0.01 - 0.015	*****	*****
Fenfluramine (Pondimin)	0.004 - 0.030	0.04 - 0.3	0.07 - 0.09	0.7 - 0.9	0.6 - 1.5	6 - 15
Fenoprofen (Nalfon)	2.7 - 6.6	27 - 6.6	*****	*****	71	710
Fentanyl (Sublimaze)	0.001 - 0.010	0.01 - 0.10	*****	*****	*****	*****
Fexofenadine (Allegra)	0.018 - 0.021	0.18 - 0.210	*****	*****	*****	*****
Fioricet (Butalbital)	0.17 - 0.26	1.7 - 2.6	0.7 - 4	7 - 40	1.3 - 2.6	13 - 26
Fiorinal (Butalbital)	0.17 - 0.26	1.7 - 2.6	0.7 - 4	7 - 40	1.3 - 2.6	13 - 26
Flecainide (Tambocar)	0.02 - 0.10	0.2 - 1.0	*****	*****	*****	*****
Flexeril (Cyclobenzaprine)	0.0015 - 0.0036	0.015 - 0.036	*****	*****	>0.04	>0.4
Flexin (Zoxazolamine)	0.3 - 1.3	3 - 13	*****	*****	*****	*****
Flubiprofen (Ansaid)	1 - 2.2	10 - 22	*****	*****	*****	*****
Flucanzol (Diflucan)	0.5 - 1.5	5 -15	*****	*****	*****	*****

DRUG	Therapeutic or Normal		Toxic		Lethal	
	mg%	ug/ml	mg%	ug/ml	mg%	ug/ml
Flumazenil (Mazicon, Romazicon)	0.0006 - 0.0039	0.006 - 0.039	*****	*****	*****	*****
Flunitrazepam (Rohypnol)	0.006 - 0.0052	0.06 - 0.052	0.001 - 0.005	0.01 - 0.05	*****	*****
Fluoride	0.0014 - 0.04	0.014 - 0.4	*****	*****	1.5 - 20	15 - 200
Fluothane (Halothane)	2.2 - 26.0	22 - 260	*****	*****	20	200
Fluoxetine (Prozac)	0.009 - 0.040	0.09 - 0.40	*****	*****	0.13 - 0.68	1.3 - 6.8
Fluphenazine (Prolixin)	0.00009-0.00170	0.0009 - 0.0170	*****	*****	*****	*****
Flurazepam (Dalmane)	0.00005-0.00280	0.0005 - 0.0280	0.02	0.2	0.05 - 0.40	0.5 - 4.0
Flurazepam (Dalmane)	0.0033 - 0.0144	0.033 - 0.144	*****	*****	*****	*****
[+met: N-Desalkylflurazepam]						
Fluvoxamine (Luvox)	0.0031 - 0.0087	0.031 - 0.087	*****	*****	*****	*****
Forane (Isoflurane)	2.0 - 7.0	20.0 - 70.0	*****	*****	*****	*****
Furadantoin (Nitrofurantoin)	0.18	1.8	*****	*****	*****	*****
Fortavase, Invirase (Saquinavir)	0.011 - 0.11	0.11 - 1.1	*****	*****	*****	*****
Furosemide (Lasix)	0.1 - 1.0	1 - 10	>2	>20	*****	*****
G						
Gabapentin (Neurontin)	0.2 - 1.0	2 - 10	*****	*****	*****	*****
Gabitrol (Tiagabine)	0.0001 - 0.0234	0.001 - 0.234	*****	*****	*****	*****
Gamma-Hydroxybutyrate (GHB)	<0.1	<1.0	2.6 - 36	26 - 360	>75	>750
GHB (Gamma-Hydroxybutyrate)	<0.1	<1.0	2.6 - 36	26 - 360	>75	>750
Glucophage (Metformin)	0.1 - 0.4	1 - 4	4.5 - 7.0	45 - 70	*****	*****
Glutethimide (Doriden)	0.2 - 1.2	2 - 12	1 - 8	10 - 80	3 - 10	30 - 100
Glycopyrrolate (Robinul)	0.005 - 0.0076	0.050 - 0.076	*****	*****	*****	*****
Gold (Sodium Aurothiomalate)	0.3 - 0.8	3 - 8	*****	*****	*****	*****
Guaifenesin (Robitussin)	0.04 - 0.14	0.4 - 1.4	21	210	*****	*****
Guanethidine (Ismelin)	0.001	0.01	*****	*****	*****	*****
H						
Habitrol (transdermal) (Nicotine)	0.0004 - 0.0444	0.004 - 0.444	*****	*****	0.14	1.4
Halcion (Triazolam)	0.002	0.02	*****	*****	*****	*****
Haldol (Haloperidol)	0.0006 - 0.0245	0.006 - 0.245	0.005 - 0.050	0.05 - 0.50	*****	*****
Haloperidol (Haldol)	0.0006 - 0.0245	0.006 - 0.245	0.005 - 0.050	0.05 - 0.50	*****	*****
Halothane (Fluothane)	2.2 - 26.0	22 - 260	*****	*****	20	200
Hexachlorophene (Phisohex)	0.0003 - 0.0650	0.003 - 0.650	*****	*****	0.22 - 3.5	2.2 - 35
Hismanol (Astemizole)	0.00004	0.0004	*****	*****	*****	*****
Hydralazine	0.02 - 0.09	0.2 - 0.9	*****	*****	*****	*****
Hydrochlorothiazide (Hydrodiuril)	0.007 - 0.038	0.07 - 0.38	*****	*****	*****	*****
Hydrocodone (Lortab, Vicodin)	0.003 - 0.025	0.03 - 0.25	0.05 - 0.2	0.5 - 2	0.07 - 1.2	0.7 - 12
Hydrodiuril (Hydrochlorothiazide)	0.007 - 0.038	0.07 - 0.38	*****	*****	*****	*****
Hydrogen Sulfide	*****	*****	*****	*****	0.092	0.92
Hydromorphone (Dilaudid)	0.0008 - 0.0049	0.008 - 0.049	****	*****	0.03	0.3
Hydroxychloroquine (Plaquenil)	0.0019 - 0.0210	0.019 - 0.210	*****	*****	6.1	61
Hydroxyzine (Atarax, Vistaril)	0.0022 - 0.008	0.022 - 0.08	*****	*****	0.4 -3.9	4.2 - 39
Hyoscine (Scopolamine)	0.00003 - 0.0019	0.0003 - 0.019	*****	*****	0.189	1.89
Hyperstat (Diazoxide)	1.5 - 2.0	15 - 20	>10	>100	*****	*****
I						
Ibuprofen (Motrin)	1.7 - 4.9	17 - 49	8.4 - 70	84 - 700	*****	*****
Imitrex (Sumatriptan)	0.0024 - 0.0095	0.024 - 0.095	*****	*****	*****	*****
Imipramine (Tofranil)	0.015 - 0.0105	0.15 - 0.105	0.05 - 0.15	0.5 - 1.5	0.28 - 0.85	2.8 - 8.5

Drug and Chemical Blood Level Data - 2001

DRUG	Therapeutic or Normal		Toxic		Lethal	
	mg%	ug/ml	mg%	ug/ml	mg%	ug/ml
Imipramine (Tofranil)	0.015 - 0.025	0.15 - 0.25	*****	*****	*****	*****
[+met: Desipramine]						
Inderal (Propranolol)	0.001 - 0.034	0.01 - 0.34	0.2	2	0.8 - 1.2	8 - 12
Indocin (Indomethacin)	0.01 - 0.40	0.1 - 4	0.6	6	*****	*****
Indomethacin (Indocin)	0.01 - 0.40	0.1 - 4	0.6	6	*****	*****
INH (Isoniazid)	0.06 - 2.0	0.6 - 20	2 - 14.3	20 - 143	6.5 - 16.8	65 - 168
Invirase, Fortovase (Saquinavir)	0.011 - 0.11	0.11 - 1.1	*****	*****	*****	*****
Ionamin (Phentermine)	0.009 - 0.051	0.09 - 0.51	*****	*****	0.15 - 0.76	1.5 - 7.6
Iron	0.027 - 0.293	0.27 - 2.93	0.28 - 2.5	2.8 - 25	2 - 5	20 - 50
Ismelin (Guanethidine)	0.001	0.01	*****	*****	*****	*****
Isoflurane (Forane)	2.0 - 7.0	20.0 - 70.0	*****	*****	*****	*****
Isoniazid (INH)	0.06 - 2.0	0.6 - 20	2 - 14.3	20 - 143	6.5 - 16.8	65 - 168
Isopropanol	*****	*****	>40	>400	>150	>1500
Isoptin (Calan, Verapamil)	0.0055 - 0.0355	0.055 - 0.355	0.09	0.9	0.09 - 8.5	0.9 - 85
Isordil (Isosorbide Dinitrate)	0.0008 - 0.0038	0.008 - 0.038	*****	*****	*****	*****
Isosorbide Dinitrate (Isordil)	0.0008 - 0.0038	0.008 - 0.038	*****	*****	*****	*****
K						
Kemadrin (Procyclidine)	0.008 - 0.063	0.08 - 0.63	*****	*****	*****	*****
Ketamine	0.02 - 0.63	0.2 - 6.3	*****	*****	*****	*****
Ketoprofen (Orudis, Actron)	0.5 - 0.15	5 - 1.5	*****	*****	*****	*****
Ketorolac (Toradol)	0.087 - 0.45	0.87 - 4.5	*****	*****	*****	*****
Klonopin (Clonazepam)	0.0007 - 0.0075	0.007 - 0.075	*****	*****	*****	*****
Kwell (Lindane)	0.0001 - 0.0031	0.001 - 0.031	0.05	0.5	0.13	1.3
L						
Labetalol (Normodyne, Trandate)	0.0036 - 0.0271	0.036 - 0.271	*****	*****	*****	*****
Lamactal *(Lamotrigine)*	0.20 - 1.90	2 - 19	1.5 - 3.6	15 - 36	*****	*****
Lamotrigine (Lamactal)	0.20 - 1.90	2 - 19	1.5 - 3.6	15 - 36	*****	*****
Lasix (Furosemide)	0.1 - 1.0	1 - 10	>2	>20	*****	*****
Lead	0.04	0.4	0.04 - 1.37	0.4 - 13.7	0.11 - 0.53	1.1 - 5.3
Leritine (Anileridine)	<0.05	<0.5	*****	*****	0.09 - 0.70	0.9 - 7.0
Levo-Dromoran (Levorphanol)	0.0007 - 0.0021	0.007 - 0.021	*****	*****	0.08 - 0.27	0.8 - 2.7
Levoprome (Methotrimeprazine)	0.002 - 0.0271	0.02 - 0.271	*****	*****	*****	*****
Levorphanol (Levo-Dromoran)	0.0007 - 0.0021	0.007 - 0.021	*****	*****	0.08 - 0.27	0.8 - 2.7
Librium (Chlordiazepoxide)	0.067 - 0.31	0.67 - 3.1	0.5	5	2	20
Lidocaine (Xylocaine)	0.15 - 0.50	1.5 - 5.0	0.7 - 2	7 - 20	>2.5	>25
Lindane (Kwell)	0.0001 - 0.0031	0.001 - 0.031	0.05	0.5	0.13	1.3
Lioresal (Baclofen)	0.01 - 0.06	0.1 - 0.6	0.11 - 0.35	1.1 - 3.5	*****	*****
Lisinopril (Prinivil, Zestril)	0.002 - 0.0082	0.02 - 0.082	*****	*****	*****	*****
Lithium	0.42 - 0.97	4.2 - 9.7	1.39	13.9	>3.47	>34.7
Lodine (Etodolac)	1.2 - 4.7	12 - 47	*****	*****	*****	*****
Lomotil (Diphenoxylate)	0.001 - 0.004	0.01 - 0.04	*****	*****	*****	*****
Lopressor (Metoprolol)	0.003 - 0.027	0.03 - 0.27	*****	*****	0.47 - 14.2	4.7 - 142
Loratadine (Claritin)	0.0007 - 0.0028	0.007 - 0.028	0.046	0.46	*****	*****
metabolite: descarboethoxyloratadine)	0.0007 - 0.0028	0.007 - 0.028	0.046	0.46	*****	*****
Lorazepam (Ativan)	0.001 - 0.024	0.01 - 0.24	0.03 - 0.06	0.3 - 0.6	*****	*****
Lortab (Hydrocodone, Vicodin)	0.003 - 0.025	0.03 - 0.25	0.05 - 0.2	0.5 - 2	0.07 - 1.2	0.7 - 12
Loxapine (Loxitane)	0.001 - 0.003	0.01 - 0.03	*****	*****	0.19 - 0.77	1.9 - 7.7

DRUG	Therapeutic or Normal		Toxic		Lethal	
	mg%	ug/ml	mg%	ug/ml	mg%	ug/ml
Loxitane (Loxapine)	0.001 - 0.003	0.01 - 0.03	*****	*****	0.19 - 0.77	1.9 - 7.7
LSD (Lysergic Acid Diethylamide,	*****	*****	0.0001 - 0.0009	0.001 - 0.009	*****	*****
Lysergide)						
Ludiomil (Maprotiline)	0.005 - 0.0718	0.05 - 0.718	0.024 - 0.080	0.24 - 0.80	0.2 - 1.3	2-13
Luvox (Fluvoxamine)	0.0031 - 0.0087	0.031 - 0.087				
Lysergic Acid Diethylamide	*****	*****	0.0001 - 0.0009	0.001 - 0.009	*****	******
(LSD, Lysergide)						
Lysergide	*****	*****	0.0001 - 0.0009	0.001 - 0.009	*****	*****
(LSD, Lysergic Acid Diethylamide)						
M						
Magnesium	1.2 - 3.2	12 -32	8 - 12	80 -120	20 - 32	200 -320
Malathion	0.0 - 0.35	0.0 - 3.5	*****	*****	0.05 - 0.35	0.5 - 3.5
Manganese [serum values]	0.00002-0.00011	0.0002 - 0.0011	0.46	4.6	*****	*****
Maprotiline (Ludiomil)	0.005 - 0.0718	0.05 - 0.718	0.024 - 0.080	0.24 - 0.80	0.2 - 1.3	2-13
Marcaine (Bupivacaine)	0.022 - 0.345	0.22 - 3.45	1	10	*****	*****
Mazicon (Flumazenil, Romazicon)	0.0006 - 0.0039	0.006 - 0.039	*****	*****	*****	*****
MDA (3,4-Methylenedioxyamphetamine)	*****	*****	*****	*****	0.18 - 2.6	1.8 - 26
Mebaral (Mephobarbital)	0.05 - 0.35	0.5 - 3.5	*****	*****	*****	*****
Mefenamic Acid (Ponstel)	0.03 - 2.00	0.3 - 20.0	1.1 - 11.0	11 - 110	*****	*****
Mellaril (Thioridazine)	0.01 - 0.26	0.1 - 2.6	0.24 - 1.18	2.4 - 11.8	0.1 - 1.8	1 - 18
Mellaril (Thioridazine)	0.03 - 0.40	0.3 - 4.0	*****	*****	*****	*****
[+met: Mesoridazine]						
Meperidine (Demerol)	0.007 - 0.080	0.07 - 0.80	0.5	5	0.8 - 2.0	8 - 20
Mephenytoin (Mesantoin)	2.5 - 4.0	25 - 40	5	50	*****	*****
[+met: N-Desmethylmephenytoin]						
Mephobarbital (Mebaral)	0.05 - 0.35	0.5 - 3.5	*****	*****	*****	*****
Mepivacaine (Carbocaine)	0.028 - 0.550	0.28 - 5.50	1	10	5	50
Meprobamate	0.2 - 2.6	2 - 26	6 - 10	60 -100	14 - 35	140 - 350
Mercury (Inorganic)	*****	*****	0.018 - 0.062	0.18 - 0.62	0.04 - 2.20	0.4 - 22.0
Mercury (Organic)	<0.008	<0.08	>0.02	>0.2	>0.06	>0.6
Mesantoin (Mephenytoin)	2.5 - 4.0	25 - 40	5	50	*****	*****
[+met: N-Desmethylmephenytoin]						
Mesoridazine (Serentil)	0.118 - 0.352	1.18 - 3.52	*****	*****	0.3	3
Mestinon (Pyridostigmine)	40	400	*****	*****	*****	*****
Metaclopramide (Reglan)	0.0072 - 0.075	0.072 - 0.75	*****	*****	*****	*****
Metaxalone (Skelaxin)	29.6	296	*****	*****	*****	*****
Metformin (Glucophage)	0.1 - 0.4	1 - 4	4.5 - 7.0	45 - 70	*****	*****
Methadone (Dolophine)	0.0075 - 0.110	0.075 - 1.10	0.02 - 0.2	0.20 - 2.0	0.04 - 0.18	0.4 - 1.8
Methamphetamine	0.001 - 0.005	0.01 - 0.05	0.06 - 0.50	0.6 - 5.0	>1	>10
Methanol	*****	*****	20	200	>89	>890
Methaqualone (Quaalude)	0.04 - 0.80	0.4 - 8.0	1 - 3	10 - 30	>0.5	>5
Methazolamide (Neptazane)	4	40	*****	*****	*****	*****
Methocarbamol (Robaxin)	2.6 - 4.1	26 - 41	*****	*****	*****	*****
Methohexital	0.34 - 1.07	3.4 - 10.7	*****	*****	9.8	98
Methotrimeprazine (Levoprome)	0.002 - 0.0271	0.02 - 0.271	*****	*****	0.08 - 0.41	0.8 - 4.1
Methoxy-O-demethylencainide	0.006 - 0.028	0.06 - 0.28	*****	*****	*****	*****
[met: Encainide]						

DRUG	Therapeutic or Normal		Toxic		Lethal	
	mg%	ug/ml	mg%	ug/ml	mg%	ug/ml
Methsuximide (Celontin)	1.0 - 4	10 - 40	4.4	>44	*****	*****
[as met: Desmethylmethsuximide]						
Methyldopa	0.10 - 0.75	1.0 - 7.5	1	10	*****	*****
Methylene Chloride (Dichloromethane)	*****	*****	*****	*****	9.5 - 60	95 - 600
3-4-Methylenedioxyamphetamines (MDA)	*****	*****	*****	*****	0.18 - 2.6	1.8 - 26
Methylfentanyl (China White)	******	******	******	******	0.0002 - 0.0011	0.002 - 0.011
Methylphenidate (Ritalin)	0.001 - 0.006	0.01 - 0.06	0.08	0.8	0.23	2.3
Methyprylon (Noludar)	0.5 - 1.5	5 - 15	3 - 6	30 - 60	10	100
Metoprolol (Lopressor)	0.003 - 0.027	0.03 - 0.27	*****	*****	0.47 - 14.2	4.7 - 142
Mexiletine (Mexitil)	0.05 - 0.20	0.5 - 2.0	*****	*****	2.1 - 4.5	21 - 45
Mexitil (Mexiletine)	0.05 - 0.20	0.5 - 2.0	*****	*****	2.1 - 4.5	21 - 45
Mianserin	0.001 - 0.016	0.01 - 0.16	0.011 - 0.050	0.11 - 0.50	0.01 - 0.26	0.1 - 2.6
Midazolam (Versed)	0.008 - 0.025	0.08 - 0.25	*****	*****	*****	*****
Milontin (Phensuximide)	0.4 - 1.4	4 - 14	8 - 15	80 - 150	*****	*****
Mirtazapine (Remeron)	0.0039 - 0.018	0.039 - 0.18	*****	*****	*****	*****
Moclobemide	0.3	3	*****	*****	5.6 - 9.0	56 - 90
Molybdenum	0.0015	0.015	*****	*****	*****	*****
Morphine	0.01	0.10	*****	*****	0.005 - 0.400	0.05 - 4.00
Motrin (Ibuprofen)	1.7 - 4.9	17 - 49	8.4 - 70	84 - 700	*****	*****
Motofen (Difenoxin)	0.016	0.160	*****	*****	*****	*****
Moxifluxacin (Avelox)	0.45 - 1.44	4.5 - 14.4	*****	*****	*****	*****
Mysoline (Primidone)	0.2 - 1.9	2 - 19	5 - 8	50 - 80	10	100
N						
N-Acetylprocainamide (NAPA)	0.2 - 1.2	2 - 12	1.6	16	*****	*****
[met: Procainamide (Pronestyl)						
N-Desalkylflurazepam	0.001 - 0.014	0.01 - 0.14	*****	*****	*****	*****
[met: Flurazepam (Dalmane)]						
N-Desmethyldiazepam (Nordiazepam)	0.01 - 0.26	0.1 - 2.6	>0.5	>5	*****	*****
[met: Clorazepate (Tranxene)]						
N-Desmethyldiazepam (Nordiazepam)	0.002 - 0.180	0.02 - 1.80	*****	*****	*****	*****
[met: Diazepam (Valium)]						
Nalfon (Fenoprofen)	2.7 - 6.6	27 - 66	*****	*****	71	710
Naloxone (Narcan)	0.001	0.01	*****	*****	*****	*****
NAPA (N-Acetylprocainamide)	0.2 - 1.2	2 - 12	1.6	16	*****	*****
[met: Procainamide (Pronestyl)						
Naprosyn (Naproxen)	3.1 - 12	31 - 120	40	400	*****	*****
Naproxen (Anaprox)	3.1 - 12	31 - 120	40	400	*****	*****
Narcan (Naloxone)	0.001	0.01	*****	*****	*****	*****
Nardil (Phenelzine)	0.0001 - 0.0002	0.001 - 0.002	*****	*****	>0.15	>1.5
Navane (Thiothixene)	0.001 - 0.010	0.01 - 0.10	*****	*****	*****	*****
Nebcin (Tobramycin)	0.16 - 0.78	1.6 - 7.8	*****	*****	*****	*****
Nefazodone (Serzone)	0.01 - 0.12	0.1 - 1.2	*****	*****	*****	*****
Nembutal (Pentobarbital)	0.1 - 0.3	1 - 3	>0.5	>5	1.0 - 16.9	10 - 169
Neo-Synephrine (Phenylephrine)	0.003	0.03	*****	*****	*****	*****
Neptazane (Methazolamide)	4	40	*****	*****	*****	*****
Nesacaine (Chloroprocaine)	0.2 - 0.4	2 - 4	*****	*****	*****	*****
Neurontin (Gabapentin)	0.2 - 1.0	2 - 10	*****	*****	*****	*****

DRUG	Therapeutic or Normal		Toxic		Lethal	
	mg%	ug/ml	mg%	ug/ml	mg%	ug/ml
Nicardipine (Cardene)	0.0036 - 0.015	0.036 - 0.150	*****	*****	*****	*****
Nickel	0.011	0.11	*****	*****	*****	*****
Nicotine	0.0004 - 0.0444	0.004 - 0.444	*****	*****	0.14	1.4
Nicotine (Transdermal)	0.0004 - 0.0031	0.004 - 0.031	*****	*****	*****	*****
(Prostep, Habitrol, Nicotrol)						
Nicotrol (Transdermal, Nicotine)	0.0004 - 0.0031	0.004 - 0.031	*****	*****	*****	*****
Nifedipine (Adalat, Procardia)	0.0015 - 0.0162	0.015 - 0.162	*****	*****	*****	*****
Nisentil (Alphaprodine)	0.087 - 0.100	0.87 - 1.00	*****	*****	*****	*****
Nitrite (Butyl Nitrite)	0.05 - 0.40	0.5 - 4	*****	*****	2.2	22
Nitro-Bid (Nitro-Dur, Nitroglycerin)	0.0002 - 0.0013	0.002 - 0.013	*****	*****	*****	*****
Nitro-Dur (Nitro-Bid, Nitroglycerin)	0.0002 - 0.0013	0.002 - 0.013	*****	*****	*****	*****
Nitrofurantoin (Furadantoin)	0.18	1.8	*****	*****	*****	*****
Nitroglycerin (Nitro-Bid, Nitro-Dur)	0.0002 - 0.0013	0.002 - 0.013	*****	*****	*****	*****
Nitroprusside [as met: Thiocyanate]	0.55 - 2.9	5.5 - 29	>10	>100	20	200
Nitrous Oxide	29 - 44	290 - 440	*****	*****	35	350
Noctec (Chloral Hydrate)	0.2 - 1.2	2 - 12	10	100	25	250
[as met: Trichloroethanol]						
Noludar (Methyprylon)	0.5 - 1.5	5 - 15	3 - 6	30 - 60	10	100
Nordiazepam (N-Desmethyldiazepam)	0.01 - 0.26	0.1 - 2.6	>0.5	>5.0	*****	*****
[met: Clorazepate (Tranxene)]						
Nordiazepam (N-Desmethyldiazepam)	0.002 - 0.180	0.02 - 1.80	*****	*****	*****	*****
[met: Diazepam (Valium)]						
Norflex (Orphenadrine)	0.003 - 0.085	0.03 - 0.85	0.2	2	0.4 - 0.8	4.0 - 8.0
Norfluoxetine [met: Fluoxetine (Prozac)]	0.0018 - 0.0466	0.018 - 0.466	*****	*****	0.09 - 0.5	0.9 - 5.0
Normodyne (Labetalol, Trandate)	0.0036 - 0.0271	0.036 - 0.271	*****	*****	*****	*****
Norpace (Disopyramide)	0.2 - 0.6	2 - 6	0.7	7	2.6	26
Norpramin (Desipramine)	0.005 - 0.0684	0.05 - 0.684	>0.05	>0.5	1 - 2	10 - 20
[met: Imipramine (Tofranil)]						
Nortriptyline (Aventyl)	0.005 - 0.0375	0.05 - 0.375	0.05	0.5	1.3	13
[met: Amitriptyline (Elavil)]						
Norverapamil	0.0160 - 0.0207	0.160 - 0.207	*****	*****	*****	*****
[met: Verapamil (Calan, Isoptin)]	0.4 - 0.8	4 - 8	1	10	>2	>20
Norvir (Ritonavir)	1.1 - 6.6	11.2 - 66.0	*****	*****	*****	*****
Novocaine (Procaine)	0.02 - 1.30	0.2 - 13.0	>2.1	>21	*****	*****
O						
O-Demethylencainide [met: Encainide]	0.01 - 0.03	0.1 - 0.3	*****	*****	*****	*****
Olanzapine (Zyprexa)	0.0009 - 0.0023	0.009 - 0.023	*****	*****	0.12	1.2
Ondansetron (Zofran)	0.0022 - 0.0114	0.022 - 0.114	*****	*****	*****	*****
Orinase (Tolbutamide)	4.3 - 9.6	43 - 96	*****	*****	64	640
Orphenadrine (Norflex)	0.003 - 0.085	0.03 - 0.85	0.2	2	0.4 - 0.8	4.0 - 8.0
Orudis (Ketoprofen)	0.5 - 0.15	5 - 1.5	*****	*****	*****	*****
Oxalate	0.2	2	*****	*****	1 - 11	10 - 110
Oxaprozin (Daypro)	0.01 - 0.04	0.1 - 0.4				
Oxazepam (Serax)	0.015 - 0.140	0.15 - 1.4	>0.2	>2	*****	*****
Oxycodone (Percodan, Oxycontin)	0.001 - 0.010	0.01 - 0.10	0.02 - 0.50	0.2 - 5.0	*****	*****
Oxycontin (Oxycodone, Percodan)	0.001 - 0.010	0.01 - 0.10	0.02 - 0.50	0.2 - 5.0	*****	*****
Oxyphenbutazone (Tandearil)	1.1 - 11.8	11 - 118	*****	*****	*****	*****

Drug and Chemical Blood Level Data - 2001

DRUG	Therapeutic or Normal		Toxic		Lethal	
	mg%	ug/ml	mg%	ug/ml	mg%	ug/ml
P						
Pancuronium (Pavulon)	0.009 - 0.022	0.09 - 0.22	*****	*****	0.16	1.6
Papaverine	0.025 - 0.400	0.25 - 4.00	*****	*****	*****	*****
Paradione (Paramethadione)	0.11 - 0.50	1.1 - 5.0	*****	*****	*****	*****
Paraldehyde	2.0 - 33.2	20 - 332	20 - 40	200 - 400	>50	>500
Paramethadione (Paradione)	0.11 - 0.50	1.1 - 5.0	*****	*****	*****	*****
Para-Methoxyamphetamine (PMA)	*****	*****	*****	*****	0.02 - 0.49	0.2 - 4.9
Paraquat	*****	*****	0.06 - 0.32	0.6 - 3.2	>1.5	>15
Parathion	*****	*****	*****	*****	0.05 - 3.40	0.5 - 34.0
Parnate (Tranylcypromine)	0.005	0.05	*****	*****	*****	*****
Paroxetine (Paxil)	0.0031 - 0.0062	0.031 - 0.062	*****	*****	0.14 - 0.34	1.4 - 3.4
Pavulon (Pancuronium)	0.009 - 0.022	0.09 - 0.22	*****	*****	0.16	1.6
Paxil (Paroxetine)	0.0031 - 0.0062	0.031 - 0.062	*****	*****	0.14 - 0.34	1.4 - 3.3
PCP (Phencyclidine)	*****	*****	0.0007 - 0.0240	0.007 - 0.240	0.1 - 0.5	1 - 5
Pemoline (Cylert)	0.07 - 0.62	0.70 - 6.2	*****	*****	*****	*****
Pentachlorophenol	*****	*****	*****	*****	>4.6	>46
Pentazocine (Talwin)	0.003 - 0.100	0.03 - 1.00	0.2 - 0.5	2 - 5	>0.03	>0.3
Pentobarbital (Nembutal)	0.1 - 0.3	1 - 3	>0.5	>5	1.0 - 16.9	10 - 169
Pentothal (Thiopental)	0.1 - 4.2	1 - 42	>0.7	>7	1 - 40	10 - 400
Pentoxifylline (Trental)	0.006 - 0.16	0.06 - 1.6	*****	*****	>0.6	>6.0
Pepcid (Famotidine)	0.0007 - 0.0035	0.007 - 0.035	*****	*****	*****	*****
Percodan (Oxycodone)	0.001 - 0.010	0.01 - 0.10	0.02 - 0.50	0.2 - 5.0	*****	*****
Perphenazine (Trilafon)	0.00004-0.00300	0.0004 - 0.0300	0.1	1	*****	*****
Phenacetin	0.01 - 2.00	0.1 - 20.0	>3	>30	*****	*****
Phencyclidine (PCP)	*****	*****	0.0007 - 0.0240	0.007 - 0.240	0.1 - 0.5	1 - 5
Phendimetrazine	0.002 - 0.024	0.02 - 0.24	*****	*****	*****	*****
Phenelzine (Nardil)	0.0001 - 0.0002	0.001 - 0.002	*****	*****	>0.15	>1.5
Phenergan (Promethazine)	0.0006 - 0.0099	0.006 - 0.099	*****	*****	0.24 - 1.2	2.4 - 12
Phenmetrazine	0.004 - 0.024	0.04 - 0.24	*****	*****	0.4	4
Phenobarbital	1 - 4	10 - 40	4 - 6	40 - 60	>8	>80
Phenol	*****	*****	*****	*****	>4.6	>46
Phensuximide (Milontin)	0.4 - 1.4	4 - 14	8 - 15	80 - 150	*****	*****
Phentermine (Ionamin)	0.009 - 0.051	0.09 - 0.51	*****	*****	0.15 - 0.76	1.5 - 7.6
Phenylbutazone (Butazolidin)	1.6 - 15.0	16 - 150	20	200	40	400
Phenylephrine (Neo-Synephrine)	0.003	0.03	*****	*****	*****	*****
Phenylpropanolamine	0.003 - 0.048	0.03 - 0.48	*****	*****	>1	>10
Phenytoin (Dilantin, Diphenylhydantoin)	1 - 2	10 - 20	2 - 5	20 -50	>10	>100
Phisohex (Hexachlorophene)	0.0003 - 0.0650	0.003 - 0.650	*****	*****	0.22 - 3.5	2.2 - 35
Phosphorus (Adult)	2.0 - 4.8	20 - 48	*****	*****	*****	*****
Phosphorus (Child)	4 - 7	40 -70	*****	*****	*****	*****
Piroxicam (Feldene)	0.085 - 0.8	0.85 - 8.00	*****	*****	*****	*****
Placidyl (Ethchlorvynol)	0.05 - 0.88	0.5 - 8.8	*****	*****	2.2 - 21.3	22 - 213
Plaquenil (Hydroxychloroquine)	0.0019 - 0.0210	0.019 - 0.210	*****	*****	6.1	61
Plendil (Felodipine)	0.00015-0.00088	0.0015 - 0.0088	0.001 - 0.0015	0.01 - 0.015	*****	*****
PMA (Para-Methoxyamphetamine)	*****	*****	*****	*****	0.02 - 0.49	0.2 - 4.9
Polythiazide (Renese)	0.2 - 0.7	2 - 7	*****	*****	*****	*****
Pondimin (Fenfluramine)	0.004 - 0.030	0.04 - 0.3	0.07 - 0.09	0.7 - 0.9	0.6 - 1.5	6 - 15

DRUG	Therapeutic or Normal		Toxic		Lethal	
	mg%	ug/ml	mg%	ug/ml	mg%	ug/ml
Ponstel (Mefenamic Acid)	0.03 - 2.00	0.3 - 20.0	1.1 - 11.0	11 - 110	*****	*****
Prazepam (Centrax)	0.001 - 0.004	0.01 - 0.04	*****	*****	*****	*****
Preludin (Phenmetrazine)	0.004 - 0.024	0.04 - 0.24	*****	*****	0.4	4
Prilocaine (Citanest)	0.1 - 0.5	1 - 5	*****	*****	*****	*****
Primidone (Mysoline)	0.2 - 1.9	2 - 19	5 - 8	50 - 80	10	100
Prinivil (Lisinopril, Zestril)	0.002 - 0.0082	0.02 - 0.082				
Probenecid (Benemid)	10 - 20	100 - 200	*****	*****	*****	*****
Procainamide (Pronestyl)	0.4 - 0.8	4 - 8	1	10	>2	>20
Procaine (Novocaine)	0.02 - 1.30	0.2 - 13.0	>2.1	>21	*****	*****
Procardia (Adalat, Nifedipine)	0.0015 - 0.0162	0.015 - 0.162	*****	*****	*****	*****
Prochlorperazine (Compazine)	*****	*****	>0.1	>1	0.5	5
Procyclidine (Kemadrin)	0.008 - 0.063	0.08 - 0.63	*****	*****	*****	*****
Prolixin (Fluphenazine)	0.00009-0.00170	0.0009 - 0.0170	*****	*****	*****	*****
Prograf (Tacrolimus)	0.0005 - 0.002	0.005 - 0.02	>0.003	>0.03	*****	*****
Promazine (Sparine)	*****	*****	>0.1	>1	>0.5	>5
Promethazine (Phenergan)	0.0006 - 0.0099	0.006 - 0.099	*****	*****	0.24 - 1.2	2.4 - 12
Pronestyl (Procainamide)	0.4 - 0.8	4 - 8	1	10	>2	>20
Propafenone (Rythmol)	0.0176 - 0.165	0.17 - 1.65	*****	*****	*****	*****
Proparacaine (Alcaine)	0.2 - 1.6	2 - 16	*****	*****	*****	*****
Propofal (Diprivan)	0.023 - 0.107	0.23 - 1.07	0.03 - 0.06	0.3 - 0.6	0.1 - 1.7	1-17
Propoxyphene (Darvon)	0.023 - 0.107	0.23 - 1.07	0.03 - 0.06	0.3 - 0.6	0.1 - 1.7	1-17
Propoxyphene (Darvon)	0.104 - 0.371	1.04 - 3.71	0.28 - 1.2	2.8 - 12	0.27 - 4.7	2.7 - 47
[+met: Norpropoxyphene						
Propranolol (Inderal)	0.6 - 71.1	6 - 711	*****	*****	*****	*****
Propylene Glycol	0.01 - 0.034	0.1 - 0.34	0.2	2	0.8 - 1.2	8 - 12
Propylhexedrine (Benzedrex)	0.001	0.01	*****	*****	0.2 - 0.3	2 - 3
Prosom (Estazolam)	0.0042 - 0.0100	0.042 - 0.100	0.125	1.25	*****	*****
Prostep (transdermal) (Nicotine)	0.0004 - 0.0031	0.004 - 0.031	*****	*****	*****	*****
Prothiaden (Dothiepin)	0.0017 - 0.0420	0.017 - 0.420	*****	*****	0.03 - 0.25	0.3 - 2.5
Protriptyline (Vivactil)	0.007 - 0.038	0.07 - 0.38	0.05 - 0.20	0.5 - 2.0	>0.1	>1
Prozac (Fluoxetine)	0.009 - 0.040	0.09 - 0.40	*****	*****	0.13 - 0.68	1.3 - 6.8
Pseudoephedrine (Sudafed)	0.050 - 0.077	0.50 - 0.77	*****	*****	1.9	19
Pyribenzamine (Tripelennamine)	0.006	0.06	*****	*****	1	10
Pyridostigmine (Mestinon)	40	400	*****	*****	*****	*****
Q						
Quaalude (Methaqualone)	0.04 - 0.80	0.4 - 8.0	1 - 3	10 - 30	>0.5	>5
Quazepam	1.1 - 14.8	11 - 148	*****	*****	*****	*****
Quetiapine (Serognel)	0.0195 - 0.0632	0.195 - 0.632	1.3	13	*****	*****
Quinidine	0.10 - 0.60	1 - 6	1	10	3 - 5	30 - 50
Quinine	0.17 - 0.97	1.7 - 9.7	>1	>10	1.2	12
R						
Rantidine (Zantac)	0.0036 - 0.0094	0.036 - 0.094	*****	*****	*****	*****
Reglan (Metaclopramide)	0.0072 - 0.075	0.072 - 0.75	*****	*****	*****	*****
Remeron (Mirtazapine)	0.0039 - 0.018	0.039 - 0.18	*****	*****	*****	*****
Remifentanil (Ultiva)	0.0003 - 0.005	0.003 - 0.05	*****	*****	*****	*****
Renese (Polythiazide)	0.2 - 0.7	2 - 7	*****	*****	*****	*****
Repoise (Butaperazine)	0.002 - 0.069	0.02 - 0.69	*****	*****	*****	*****

DRUG	Therapeutic or Normal		Toxic		Lethal	
	mg%	ug/ml	mg%	ug/ml	mg%	ug/ml
Restoril (Temazepam)	0.04 - 0.09	0.4 - 0.9	*****	*****	*****	*****
Retrovir (AZT, Zidovadine)	0.027 - 0.08	0.27 - 0.8	*****	*****	*****	*****
Rezulin (Troglitazone)	0.1 - 0.3	1 - 3	*****	*****	*****	*****
Risperdal (Risperidone)	0.0003 - 0.0012	0.003 - 0.012	*****	*****	*****	*****
Risperidone (Risperdal)	0.0003 - 0.0012	0.003 - 0.012	*****	*****	*****	*****
9-Hydroxy Risperidone	0.099	0.990	*****	*****	*****	*****
Ritalin (Methylphenidate)	0.001 - 0.006	0.01 - 0.06	0.08	0.8	0.23	2.3
Ritonavir (Norvir)	1.1 - 6.6	11.2 - 66.0	*****	*****	*****	*****
Robaxin (Methocarbamol)	2.6 - 4.1	26 - 41	*****	*****	*****	*****
Robinul (Glycopyrrolate)	0.005 - 0.0076	0.050 - 0.076	*****	*****	*****	*****
Robitussin (Guaifenesin)	0.04 - 0.14	0.4 - 1.4	21	210	*****	*****
Rofecoxib (Vioxx)	0.016 - 0.032	0.16 - 0.32	*****	*****	*****	*****
Rohypnol (Flunitrazepam)	0.006 - 0.0052	0.06 - 0.052	0.001 - 0.005	0.01 - 0.05	*****	*****
Romazicon (Flumazenil, Mazicon)	0.0006 - 0.0039	0.006 - 0.039	*****	*****	*****	*****
Rythomol (Propafenone)	0.0176 - 0.165	0.17 - 1.65	*****	*****	*****	*****
S						
Salicylamide	0.5	5.0	*****	*****	4	40
Salicylate	2 - 10	20 - 100	15 - 30	150 - 300	50	500
[met: Acetylsalicylic Acid - for normal usage]						
Salicylate	2 - 25	20 - 250	*****	*****	*****	*****
[met: Acetylsalicylic Acid-for rheumatoid arthritis]						
Sandimmune (Cyclosporine)	0.005 - 0.045	0.050 - 0.045	*****	*****	*****	*****
Sandoptal (Butalbital)	0.17 - 0.26	1.7 - 2.6	0.7 - 4	7 - 40	1.3 - 2.6	13 - 26
Saquinavir (Invirase, Fortovase)	0.011 - 0.11	0.11 - 1.1	*****	*****	*****	*****
Scopolamine (Hyoscine)	0.00003 - 0.0019	0.0003 - 0.019	*****	*****	0.189	1.89
Secobarbital (Seconal)	0.1 - 0.22	1 - 2.2	>0.3	>3	0.5 - 5.2	5 - 52
Seconal(Secobarbital)	0.1 - 0.22	1 - 2.2	>0.3	>3	0.5 - 5.2	5 - 52
Sectral (Acebutolol)	0.05 - 0.12	0.5 - 1.2	*****	*****	*****	*****
Seldane (Terfenadine) [as active metabolite]	0.0133 - 0.0423	0.133 - 0.423	*****	*****	*****	*****
Selegine (Eldepryl)	0.0009 - 0.0019	0.009 - 0.019	*****	*****	*****	*****
Serax (Oxazepam)	0.015 - 0.140	0.15 - 1.40	>0.2	>2	*****	*****
Serentil (Mesoridazine)	0.118 - 0.352	1.18 - 3.52	*****	*****	0.3	3
Seroflurane (Serofrane)	1.34	13.4	*****	*****	*****	*****
Serofrane (Seroflurane)	1.34	13.4	*****	*****	*****	*****
Serognel (Quetiapine)	0.0195 - 0.0632	0.195 - 0.632	1.3	13	*****	*****
Sertraline (Zoloft)	0.0055 - 0.025	0.055 - 0.25	*****	*****	*****	*****
Serzone (Nefazodone)	0.01 - 0.12	0.1 - 1.2	*****	*****	*****	*****
Sildenafil (Viagra)	0.0127 - 0.115	0.127 - 1.15	*****	*****	*****	*****
Simvastatin (Zocor)	0.00027-0.00056	0.0027 - 0.0056	*****	*****	*****	*****
Sinequan (Doxepin)	0.010 - 0.025	0.10 - 0.25	0.012 - 0.43	0.12 - 4.3	0.2 - 2.6	2 -26
Sinequan (Doxepin)	0.010 - 0.025	0.10 - 0.25	>0.05	>0.5	0.8 - 3.5	8 - 35
[+met: N-Desmethyldoxepin]						
Skelaxin (Metaxalone)	29.6	296	*****	*****	*****	*****
Sodium Aurothiomalate (Gold)	0.3 - 0.8	3 - 8	*****	*****	*****	*****
Soma (Carisoprodol)	1 - 4	10 - 40	3 - 5	30 - 50	11	110
Sparine (Promazine)	*****	*****	>0.1	>1	>0.5	>5
Stadol (Butorphanol)	0.00011-0.00017	0.0011 - 0.0017	*****	*****	*****	*****

DRUG	Therapeutic or Normal		Toxic		Lethal	
	mg%	ug/ml	mg%	ug/ml	mg%	ug/ml
Stelazine (Trifluoperazine)	0.05 - 0.20	0.5 - 2.0	0.12 - 0.30	1.2 - 3.0	0.3 - 0.8	3 - 8
Strychnine	*****	*****	0.2	2	0.28 - 1.20	2.8 - 12.0
Sublimaze (Fentanyl)	0.001 - 0.010	0.01 - 0.10	*****	*****	*****	*****
Sudafed (Pseudoephedrine)	0.050 - 0.077	0.50 - 0.77	*****	*****	1.9	19
Sufenta (Sufentanil)	0.0001 - 0.0011	0.001 - 0.011	*****	*****	*****	*****
Sufentanil (Sufenta)	0.0001 - 0.0011	0.001 - 0.011	*****	*****	*****	*****
Sulfadiazine	8 - 15	80 - 150	*****	*****	*****	*****
Sulfaguanidine	3 - 5	30 - 50	*****	*****	*****	*****
Sulfanilamide	10 - 15	100 - 150	*****	*****	*****	*****
Sulfisoxazole	9 - 10	90 - 100	*****	*****	*****	*****
Sulindac (Clinoril)	0.4 - 0.5	4 - 5	*****	*****	*****	*****
Sumatriptan (Imitrex)	0.0024 - 0.0095	0.024 - 0.095	*****	*****	*****	*****
Surmontil (Trimipramine)	0.001 - 0.030	0.01 - 0.30	*****	*****	0.87 - 1.20	8.7 - 12.0
Symmetrel (Amantadine)	0.006 - 0.031	0.06 - 0.31	0.1 - 0.05	1 - 0.5	0.21 - 0.48	2.1 - 4.8
T						
Tacrolimus (Prograf)	0.0005 - 0.002	0.005 - 0.02	>0.003	>0.03	*****	*****
Tagamet (Cimetidine)	0.05 - 0.45	0.5 - 4.5	*****	*****	*****	*****
Talwin (Pentazocine)	0.003 - 0.100	0.03 - 1.00	0.2 - 0.5	2 - 5	>0.03	>0.3
Tambocar (Flecainide)	0.02 - 0.10	0.2 - 1.0	*****	*****	*****	*****
Tandearil (Oxyphenbutazone)	1.1 - 11.8	11 - 118	*****	*****	*****	*****
Taractan (Chlorprothixene)	0.004 - 0.030	0.04 - 0.30	0.04 - 0.08	0.4 - 0.8	*****	*****
Tegretol (Carbamazepine)	0.14 - 1.2	1.4 - 12	>1.5	>15	>5	>50
Temazepam (Restoril)	0.04 - 0.09	0.4 - 0.9	*****	*****	*****	*****
Tenormin (Atenolol)	0.02 - 0.07	0.20 - 0.70	3.5	35	*****	*****
Tenuate (Diethylpropion)	0.0007 - 0.0200	0.007 - 0.200	*****	*****	0.54	5.4
Terbutaline (Brethine)	0.0002 - 0.0006	0.002 - 0.006	*****	*****	0.004	0.04
Terfenadine (Seldane) [as active metabolite]	0.0133 - 0.0423	0.133 - 0.423	*****	*****	*****	*****
Tetrachloroethylene	*****	*****	*****	*****	0.45 - 4.0	4.5 - 44.0
Tetrahydrocannabinol (THC)	<0.019	<0.19	*****	*****	*****	*****
Thallium	<0.008	<0.08	>0.1	>1	0.05 - 1.10	0.5 - 11.0
THC (Tetrahydrocannabinol)	<0.019	<0.19	*****	*****	*****	*****
Theophylline (Aminophylline)	1 - 2	10 - 20	3 - 4	30 - 40	5 - 25	50 - 250
Thiocyanate	0.6 - 2.9	6 - 29	*****	*****	*****	*****
Thiocyanate [met: Nitroprusside]	0.55 - 2.9	5.5 - 29	>10	>100	20	200
Thiopental (Pentothal)	0.1 - 4.2	1 - 42	>0.7	>7	1 - 40	10 - 400
Thioridazine (Mellaril)	0.01 - 0.26	0.1 - 2.6	>0.5	>5	0.1 - 1.8	1 -18
Thioridazine (Mellaril)	0.03 - 0.40	0.3 - 4.0	*****	*****	*****	*****
[+met: Mesoridazine]						
Thiothixene (Navane)	0.001 - 0.010	0.01 - 0.10	*****	*****	*****	*****
Thorazine (Chlorpromazine)	0.001 - 0.050	0.01 - 0.50	0.1 - 0.2	1 - 2	0.3 - 1.2	3 - 12
Tiagabine (Gabitrol)	0.0001 - 0.0234	0.001 - 0.234	*****	*****	*****	*****
Tigan (Trimethobenzamide)	0.1 - 0.2	1 - 2	*****	*****	*****	*****
Timolol (Blocadren)	0.004 - 0.023	0.04 - 0.23	*****	*****	*****	*****
Tin	0.012 - 0.014	0.12 - 0.14	*****	*****	*****	*****
Tobramycin (Nebcin)	0.16 - 0.78	1.6 - 7.8	*****	*****	*****	*****
Tocainide (Tonocard)	0.4 - 1.0	4 - 10	*****	*****	*****	*****
Tofranil (Imipramine)	0.015 - 0.0105	0.15 - 0.105	0.05 - 0.15	0.5 - 1.5	0.28 - 0.85	2.8 - 8.5

DRUG	Therapeutic or Normal		Toxic		Lethal	
	mg%	ug/ml	mg%	ug/ml	mg%	ug/ml
Tofranil (Imipramine) [+met: Desipramine]	0.015 - 0.025	0.15 - 0.25	*****	*****	*****	*****
Tolbutamide (Orinase)	4.3 - 9.6	43 - 96	*****	*****	64	640
Tolectin (Tolmetin)	3.7	37	>6	>60	*****	*****
Tolmetin (Tolectin)	3.7	37	>6	>60	*****	*****
Toluene	*****	*****	*****	*****	1	10
Tonocard (Tocainide)	0.4 - 1.0	4 - 10	*****	*****	*****	*****
Toradol (Ketorolac)	0.087 - 0.45	0.87 - 4.5	*****	*****	*****	*****
Tramadol (Ultram)	0.01 - 0.06	0.1 - 0.6				
Trancopal (Chlormezanone)	0.25 - 0.88	2.5 - 8.8	*****	*****	*****	*****
Trandate (Labetalol, Normodyne)	0.0036 - 0.0271	0.036 - 0.271	*****	*****	*****	*****
Tranxene (Chlorazepate)	0.01 - 0.16	0.1 - 1.6	>0.5	>5.0	*****	*****
[as met: N-Desmethyldiazepam						
Tranylcypromine (Parnate)	0.005	0.05	*****	*****	*****	*****
Trazodone (Desyrel)	0.07 - 0.489	0.7 - 4.89	*****	*****	1.5	15
Trental (Pentoxifylline)	0.006 - 0.16	0.06 - 1.6	*****	*****	>0.6	>6.0
Triazolam (Halcion)	0.002	0.02	*****	*****	*****	*****
Tribromoethanol	*****	*****	*****	*****	9	90
Trichloroethane	*****	*****	*****	*****	10 - 100	100 - 1000
Trichloroethanol	0.2 - 1.2	2 - 12	10	100	25	250
[met: Chloral Hydrate (Noctec)]						
Trichloroethylene	0.1 - 9.0	1 - 90	*****	*****	0.3 - 11.0	3 - 110
Tridione (Trimethadione)	1 - 3	10 - 30	*****	*****	*****	*****
Trifluoperazine (Stelazine)	0.05 - 0.20	0.5 - 2.0	0.12 - 0.30	1.2 - 3.0	0.3 - 0.8	3 - 8
Trilafon (Perphenazine)	0.00004-0.00300	0.0004 - 0.0300	0.1	1	*****	*****
Trimethadione (Tridione)	1 - 3	10 - 30	*****	*****	*****	*****
Trimethobenzamide (Tigan)	0.1 - 0.2	1 - 2	*****	*****	*****	*****
Trimethoprim (Trimpex)	0.1 - 0.2	1 - 2	*****	*****	*****	*****
Trimipramine (Surmontil)	0.001 - 0.030	0.01 - 0.30	*****	*****	0.87 - 1.20	8.7 - 12.0
Trimpex (Trimethoprim)	0.1 - 0.2	1 - 2	*****	*****	*****	*****
Tripelennamine (Pyribenzamine)	0.006	0.06	*****	*****	1	10
Triprolidine (Actidil)	0.0004 - 0.0044	0.004 - 0.044	*****	*****	*****	*****
Tubocurarine	0.004 - 0.600	0.04 - 6.00	*****	*****	*****	*****
Tylenol (Acetaminophen)	1 - 2	10 - 20	15	150	>16	>160
U						
Ultiva (Remifentanil)	0.0003 - 0.005	0.003 - 0.05	*****	*****	*****	*****
Ultram (Tramadol)	0.01 - 0.06	0.1 - 0.6				
Unisom (Doxylamine)	0.0069 - 0.0138	0.069 - 0.138	*****	*****	0.07 - 1.2	0.7 - 12
Uric Acid	3 - 7	30 - 70	*****	*****	*****	*****
V						
Valium (Diazepam)	0.002 - 0.400	0.02 - 4.00	0.5 - 2.0	5 - 20	>3	>30
Valium (Diazepam)	0.031 - 0.600	0.31 - 6.00	*****	*****	>3.4	>34
[+met: N-Desmethyldiazepam						
Valmid (Ethinamate)	0.4 - 1.1	4 - 11	*****	*****	10 - 20	100 - 200
Valproic Acid (Depakene)	5 - 10	50 - 100	0.71 - 20.0	7.1 - 200	*****	*****
Vancomycin	3 - 4	30 - 40	*****	*****	*****	*****
Vasotec (Enalapril)	0.00063 - 0.007	0.0063 - 0.070	*****	*****	*****	*****
Venlafaxine (Effexor)	0.007 - 0.393	0.07 - 3.93	*****	*****	*****	*****

DRUG	Therapeutic or Normal		Toxic		Lethal	
	mg%	ug/ml	mg%	ug/ml	mg%	ug/ml
[met: O-Desmethylvenlafaxine]	0.0061 - 0.075	0.061 - 0.75	0.1 - 0.15	1 - 1.5	*****	*****
Verapamil (Calan, Isoptin)	0.0055 - 0.0355	0.055 - 0.355	0.09	0.9	0.09 - 8.5	0.9 - 85
Versed (Midazolam)	0.008 - 0.025	0.08 - 0.25	*****	*****	*****	*****
Viagra (Sildenafil)	0.0127 - 0.115	0.127 - 1.15				
Vicodin (Hydrocodone, Lortab)	0.003 - 0.025	0.03 - 0.25	0.05 - 0.2	0.5 - 2	0.07 - 1.2	0.7 - 12
Vioxx (Rofecoxib)	0.016 - 0.032	0.16 - 0.32	*****	*****	*****	*****
Vivactil (Protriptyline)	0.007 - 0.038	0.07 - 0.38	0.05 - 0.20	0.5 - 2.0	>0.1	>1
Vistaril (Atarax, Hydroxyzine,)	0.0022 - 0.008	0.022 - 0.08	*****	*****	0.4 - 3.9	4.2 - 39
Vistazine (Hydroxyzine)	0.008	0.08	1.3	13	3.9	39
Voltaren (Diclofenac, Cataflam)	0.075 - 0.20	0.75 - 2.0	0.6	6	*****	*****
W						
Warfarin (Coumadin)	0.10 - 0.31	1. 0 - 3.1	*****	*****	*****	*****
Wellbutrin (Bupropion)	0.0025 - 0.0100	0.025 - 0.100	*****	*****	0.73	7.3
X						
Xanax (Alprazolam)	0.0025 - 0.0102	0.025 - 0.102	*****	*****	0.0122 - 0.039	0.122 - 0.390
Xylene	*****	*****	*****	*****	0.3 - 11.0	3 - 110
Xylocaine (Lidocaine)	0.15 - 0.50	1.5 - 5.0	0.7 - 2	7 - 20	>2.5	>25
Y						
Yocon (Yohimbine)	0.0046 - 0.029	0.046 - 0.290	*****	*****	*****	*****
Yohimbine (Yocon)	0.0046 - 0.029	0.046 - 0.290	*****	*****	*****	*****
Z						
Zantac (Rantidine)	0.0036 - 0.0094	0.036 - 0.094	*****	*****	*****	*****
Zarontin (Ethosuximide)	4 - 10	40 - 100	*****	*****	25	250
Zestril (Lisinopril, Prinivil)	0.002 - 0.0082	0.02 - 0.082				
Zidovadine (AZT, Retrovir)	0.027 - 0.08	0.27 - 0.8	*****	*****	*****	*****
Zilenton (Zyflo)	0.04 - 0.31	0.4 - 3.1	*****	*****	*****	*****
Zinc	0.068 - 0.136	0.68 - 1.36	*****	*****	*****	*****
Zocor (Simvastatin)	0.00027-0.00056	0.0027 - 0.0056	*****	*****	*****	*****
Zofran (Ondansetron)	0.0022 - 0.0114	0.022 - 0.114	*****	*****	*****	*****
Zolmitriptan (Zomig)	0.0029 - 0.0272	0.029 - 0.272	*****	*****	0.05 - 0.112	0.5 - 1.12
Zoloft (Sertraline)	0.0055 - 0.025	0.055 - 0.25	*****	*****	*****	*****
Zolpidem (Ambien)	0.0003 - 0.0018	0.003 - 0.018	*****	*****	*****	*****
Zomig (Zolmitriptan)	0.0029 - 0.0272	0.029 - 0.272	*****	*****	0.05 - 0.112	0.5 - 1.12
Zoxazolamine (Flexin)	0.3 - 1.3	3 - 13	*****	*****	*****	*****
Zyflo (Zilenton)	0.04 - 0.31	0.4 - 3.1	*****	*****	*****	*****
Zyprexa (Olanzapine)	0.0009 - 0.0023	0.009 - 0.023	*****	*****	0.12	1.2