Executive Summary

Article Title: Revisited: Therapeutic and Toxic Blood Concentrations of More Than 1100 Drugs and Other Xenobiotics

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Study Purpose or Objective(s):

- This article compiles and summarizes the therapeutic and toxic plasma concentration ranges and half-lives of more than 1100 drugs and other xenobiotics. Data was abstracted from papers, text books, and other compilations and presented in tables within the article.
- These data can be useful in determining clinical case severity, the determination of need of intensive care, for therapeutic monitoring of pharmacotherapies, assessing acute and chronic intoxications and support for forensic and clinical expert opinions.
- Overall objection: to offer a "carefully references compilation of therapeutic and toxic plasma concentration ranges as well as half-lives of a large number of drugs and other xenobiotics for quick and comprehensive information"

Introduction:

- Total encounters with drugs decreased by 3.8% from 2016 (Poison Control Center); though more serious outcomes increased by 3.1%
- Concentration of ingested substance or the metabolite (in plasma/serum) better predicts the clinical severity of the case and potential outcome (when compared to the "assumed" amount and time of ingestion)
- Other than acute and chronic intoxications, blood draws should be done for the following reasons: signs of overdose occur though assumed dose is within normal range; there is no efficacy though dose is correct; medication non-adherence is expected

Study Strengths:

- Includes new psychoactive substances (NPS) and other illegal drugs that have become known to cause intoxication; all data are carefully referenced and the annotations providing details were updated and revised

General Information:

- The following categories were used to group analytical data:
    - **Therapeutic:** blood (plasma or serum) concentrations observed following therapeutically effective doses; no or only minimal side effects (drugs); "normal": concentrations associated with no or only minimal toxic effects (other xenobiotics or environmental exposure) or achieved by a typical dosing regimen (illegal drugs).
    - **Toxic:** blood (plasma/serum) concentrations producing toxicity or clinically relevant adverse effects.
    - **Comatose-fatal:** blood (plasma/serum for comatose) concentrations and whole blood (for fatal) concentrations reported to have caused coma and death, respectively. Whether published data for deaths refer to levels measured ante-mortem or post-mortem (femoral or heart blood) is, however, often unknown.

Summary Results:

- In overdose and intoxication, concentration of the ingested substance in blood is a better predictor of the clinical severity of the case when compared to the assumed amount and time of ingestion
- Elimination half-lives are statistically more reliable than data from intoxications

Considerations for Interpretations:

- Substantial deviations from reported half-lives can occur
- Most of the pharmacokinetic parameters are obtained from low doses administered in healthy subjects
- Data typically deals with the terminal elimination half-life only

Subcommittee Commentary

Prosecutorial Perspective:

- Anytime there are charts showing "therapeutic"/normal, toxic, etc. levels of any drugs they are going to be purposefully or unknowingly misused by attorneys. Attorneys tend to rely too much on these types of charts on drug-impaired driving cases.
- Attorneys tend to rely too much on these types of charts on drug-impaired driving cases. This is the issue. Remember that therapeutic means the user is no longer normal in the use of their physical or mental faculties, something changed. These charts focus on side effects, but that is not the whole picture. Prosecutors and DRE's should use this chart for ease but should rely on toxicologist to explain it.

Enforcement Perspective:

- The availability of a chart of the therapeutic and toxic concentration of drugs in blood is an important tool in impaired driving cases. Identifying all drugs, both licit and illicit, used by the suspect is needed so that the lab knows what to test for in the suspect's blood. Drug interactions and levels above what is therapeutic is important information for the prosecutor and can be useful to convince the jury of the suspect's impairment.
- The search of the suspect and vehicle after arrest as well as the suspect's interview become even more important. Obtaining answers to suspect's history of drug use, medications or drugs taken, last consumed or used, etc., can assist the lab in knowing what to test for in the specimen, and assist the prosecutor in knowing what questions to ask witnesses during trial. The officer generally has a limited period to obtain that information, generally prior to arrest and during booking.
- The information provided by the chart does not necessarily assist the officer in their decision-making process, as they will have no idea of the drug levels in the suspect's system prior to arrest. They may be able to consider drug interactions when there are combinations of different drugs. The information may assist by helping explain the presence of certain indicators a Drug Recognition Expert may see during a DRE evaluation.

Toxicology Perspective:

- This is a comprehensive compilation of drugs and other substances with therapeutic, toxic, and fatal concentrations.
- The authors were correct to note the limitations of the data. While this is most certainly a useful tool, it should be used only with a solid understanding of these limitations, especially when being used for interpretation of toxicology results for DWI prosecution.

Research and Evaluation Perspective:

- As noted, the half-life can vary depending on numerous factors, and because most studies were done under controlled situations, this variation is unknown.
- Careful consideration should be used when utilizing the summary chart in real-life drug-impaired situations; only those with direct expertise in toxicology.
- It is appreciated, however, that this publication does due diligence in summarizing an immense amount of literature to be used by experts in the field.

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Critical Care

REVIEW Open Access

Revisited: Therapeutic and toxic blood concentrations of more than 1100 drugs and other xenobiotics

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Abstract

In order to assess the significance of drug/substance levels measured in intensive care medicine and clinical and forensic toxicology as well as for therapeutic drug monitoring, it is essential that a comprehensive collection of data is readily available. We revisited and expanded our 2012 compilation of therapeutic and toxic plasma concentration ranges as well as half-lives of now more than 1100 drugs and other xenobiotics.

Data have been abstracted from original papers, text books, and previous compilations and have been completed with data collected in our own forensic and clinical toxicology laboratories. We compiled the data presented in the table and the corresponding annotations over the past 30+ years. A previous compilation was completely double-checked, revised, and updated, if necessary. In addition, more than 200 substances, especially drugs who have been introduced since 2012 to the market as well as illegal drugs and other xenobiotics which became known to cause intoxications were added. We carefully referenced all data. Moreover, the annotations providing details were updated and revised, when necessary.

For more than 1100 drugs and other xenobiotics, therapeutic ("normal") and, if data was available, toxic, and comatose-fatal plasma/blood concentrations as well as elimination half-lives were compiled in a table.

In case of intoxications, the blood concentration of the substance and/or metabolite better predicts the clinical severity of the case when compared to the assumed amount and time of ingestion. Comparing and contrasting the clinical case against the data provided, including the half-life, may support the decision for or against further intensive care. In addition, the data provided are useful for the therapeutic monitoring of pharmacotherapies, to facilitate the diagnostic assessment and monitoring of acute and chronic intoxications as well as to support forensic and clinical expert opinions.

Keywords: Critical care, Drug monitoring, Drug-related side effects and adverse reactions, Humans, Overdose, Intoxication, Xenobiotics/blood, Xenobiotics/toxicity

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Introduction

Drug overdose has become the leading cause of death from injury in the USA [1]. In 2017, more than 2.6 million closed encounters were logged by the American Association of Poison Control Centers' National Poison Data System and 2.12 million were related to human exposures. Although the total encounters showed a 3.8% decline from 2016, human exposures with more serious outcomes increased 3.1%. Consistent with previous years, the top five substance classes most frequently involved in all human exposures included three drug classes: analgesics (11.1%), household cleaning substances (7.4%), cosmetics/personal care products (6.8%), sedatives/hypnotics/antipsychotics (5.7%), and antidepressants (5.0%) [2]. According to the UK's National Poisons Information Service Annual Report 2017/2018, around 160,000 hospital presentations occur annually as a result of poisoning, most frequently in the context of deliberate self-harm [3].

In case of intoxication or poisoning, the concentration of the ingested substance and/or metabolite in plasma/serum better predicts the clinical severity of the case and the potential outcome when compared to the assumed amount and time of ingestion. In addition, it is recommended that plasma concentrations of drugs having a narrow therapeutic range or with a highly variable response (such as in psychiatry) have to be measured and monitored. Apart from acute and chronic intoxications, it is indicated to draw blood samples for the following reasons: if doses are high and borderline, if signs of over-dosage occur although the dose is within normal range (e.g. genetic polymorphism), if there is no efficacy although the dose is correct, or if medication non-adherence can be expected [4].

In general, blood concentrations of drugs at steady state are retrievable from the dosage and pharmacokinetic data. However, sufficient pharmacokinetic data are often not available. Moreover, searching, retrieving, reading, analysing, and interpreting the relevant pharmacological, toxicological, and critical care literature in case of acute intoxications in daily intensive care practice are time-consuming and may delay or even mislead optimal clinical decisions. Therefore, it makes sense to offer a carefully referenced compilation of therapeutic and toxic plasma concentration ranges, as well as half-lives, of a large number of drugs and other xenobiotics for quick and comprehensive information [4].

Materials and methods

The data presented in the table and the corresponding annotations (Additional file 1) have been developed over the past 30+ years. A previous compilation [4] has been completely revised and updated where necessary. In addition, more than 200 substances, especially drugs that have been introduced since then were added. Furthermore, we included new psychoactive substances (NPS), marketed as 'legal highs', as well as other illegal drugs which became known to cause intoxications. All data were carefully referenced. Moreover, the annotations providing details were updated and revised, if necessary.

Reviews, text books, compilations of other authors (mainly [5–25]), and most importantly, original publications concerning individual drugs, pharmacokinetic studies, and case reports have been used to set up and keep the database updated. Experience gained over more than 30 years from working in the clinical and forensic toxicological field contributed to the data presented.

The substances were selected by clinical and toxicological aspects, by frequency of prescribing or (mis-)use and other matters in the area of intensive care medicine as well as clinical and forensic toxicology.

The following clinical categories were used for grouping analytical data:

Therapeutic: blood (plasma or serum) concentrations observed following therapeutically effective doses; no or only minimal side effects (drugs); "normal": concentrations associated with no or only minimal toxic effects (other xenobiotics or environmental exposure) or achieved by a typical dosing regimen (illegal drugs).
Toxic: blood (plasma/serum) concentrations producing toxicity or clinically relevant adverse effects.
Comatose-fatal: blood (plasma/serum for comatose) concentrations and whole blood (for fatal) concentrations reported to have caused coma and death, respectively. Whether published data for deaths refer to levels measured ante-mortem or post-mortem (femoral or heart blood) is, however, often unknown.

Results and discussion

For more than 1100 drugs and other xenobiotics, therapeutic ("normal") and, if data was available, toxic, and comatose-fatal plasma/blood concentrations and elimination half-lives were compiled in one table (Additional file 1).

The compilation includes data for centrally active substances (e.g. anaesthetics, antidepressants, antiepileptics, antiparkinson drugs, antipsychotics, anxiolytics, hypnotics, lithium, opioids, sedatives, stimulants), cardiovascular drugs (e.g. angiotensin-converting enzyme inhibitors, angiotensin receptor antagonists [sartanes], antiarrhythmics, anticoagulants, antihypertensives, antiplatelets, beta blockers, calcium-channel blockers, cardiac glycosides, diuretics, lipid lowering drugs, nitrates), antimicrobial agents (e.g. antibiotics, antimalarials, antimycotics, antiretrovirals), and anabolics, non-opioid analgesics including non-steroidal anti-inflammatory drugs, antiasthmatics, anticancer drugs, antidiabetics, antihistamines, corticosteroids,

- In overdose and intoxication, the concentration of the ingested substance in blood better predicts the clinical severity of the case when compared to the assumed amount and time of ingestion.
- The most current and comprehensive single source of data for more than 1,100 drugs and other xenobiotics is provided.
- It can support the clinical decision making in case of acute or chronic intoxications.
- Comparing and contrasting the clinical case against the data provided, including the half-life, may support the decision for or against further intensive care.

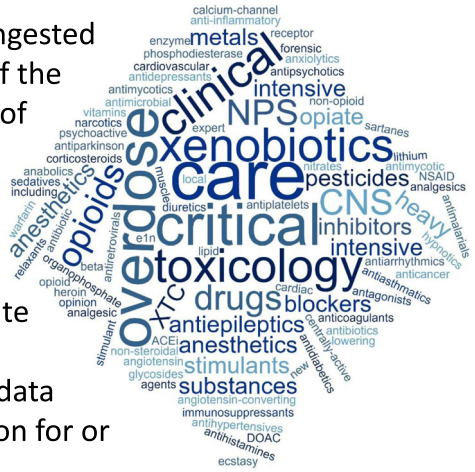

Fig. 1 Summary findings

immunosuppressants, local anaesthetics, muscle relaxants, phosphodiesterase inhibitors, and vitamins, among others (Fig. 1).

In addition and if data were available, other relevant xenobiotics such as controlled substances, illegal and recreational drugs, including new psychoactive substances, heavy metals, and pesticides, among others were listed.

To the best of our knowledge, this compilation is the most current and comprehensive single source of data, necessary to support the clinical decision-making and assessing blood concentrations in case of acute or chronic intoxications. Inter-individual deviation is, however, high. Therefore, any data listed can only be taken as an orientation.

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

Many data about "comatose" or even "fatal" plasma/blood concentrations are consciously oriented on life threatening or lethal intoxications where low plasma/blood concentrations were detected. Considering these data may prevent underestimation of actual or potential dangers in clinical cases. Many intoxicated patients survived even with significantly higher plasma 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 frequently unknown. In any case, it is more reliable to have the correct concentration measured rather than assuming how much drug/substance has been taken.

For a variety of data representing lethal cases, it is not known whether ante- or post-mortem, that is, (venous) femoral or heart blood levels were measured. If this information is unknown, we refrained from mentioning this detail.

Elimination half-lives are statistically more reliable than data gathered in case of intoxications. Yet even with this data, substantial deviation occurs. 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.

Conclusions

In case of acute or chronic intoxications, the concentration of the ingested substance and/or metabolite in blood much better predicts the clinical severity of the case when compared to the assumed amount and time of ingestion. Comparing and contrasting the clinical case against the data provided, including the half-life, may support the decision for or against further intensive care. In addition, the data provided are useful for the therapeutic monitoring of pharmacotherapies, to facilitate the diagnostic assessment and monitoring of acute and chronic intoxications as well as to support forensic and clinical expert opinions.

Supplementary information

Supplementary information accompanies this paper at https://doi.org/10.1186/s13054-020-02915-5.

Additional file 1. Therapeutic ("normal"), toxic, and comatose-fatal blood-plasma concentrations (mg/L, if not stated otherwise) in man. A table containing data for more than 1100 drugs and other xenobiotics in man including annotations and references.

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Authors' contributions
MS had the original idea, critically analysed the available data, reviewed other compilations and textbooks, searched and retrieved most of the original papers, and drafted the manuscript. AS provided data of several thousand cases analysed during his time as head of the toxicological laboratory, Institute of Legal Medicine, University Medical Centre Hamburg-Eppendorf. SIB and HAS critically reviewed all data, searched and analysed all available review sources, and provided data as well as references for new substances including case reports analysed in their toxicological laboratories. All authors developed and published the previous compilation [4]. All authors read and approved the final manuscript.

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Competing interests
The authors declare that they have no competing interests.

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Publisher's Note

Additional file 1 to

Revisited: Therapeutic and toxic blood concentrations of more than 1,100 drugs and other xenobiotics

Martin Schulz, Achim Schmoldt, Hilke Andresen-Streichert and Stefanie Iwersen-Bergmann; Critical Care 2020

Therapeutic ("normal"), toxic, and comatose-fatal blood-plasma concentrations (mg/L) in man

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Abacavir (ABC)	0.9-3.9[308]			appr. 1.5	[1, 2]
Abiraterone	appr. 0.02-0.2			12	[780]
5-ABP	see 5-(2-Aminopropyl) benzofuran				
Acamprosate	0.25-0.7[231]	1[311]		(3-) 13-20 (-33)[232]	[3-5]
Acebutolol[1]	0.2-2 (0.5-1.26)[1]		15-20	3-11	[6-8]
Acecainide	see (N-Acetyl-)Procainamide				
Acecarbromal(um)	10-20 (sum)	25-30			[8, 9], [13]
Acemetacin	see Indometacin				
Acenocoumarol	0.03-0.1[197]	0.1-0.15		3-11	[3], [9-11]
Acetaldehyde	0-30	100-125			[10, 11]
Acetaminophen	see Paracetamol				

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Acetazolamide	(4-) 10-20[267]	25-30		2-6 (-13)	[3], [11-14]
Acetohexamide	20-70	500		1.3	[15], [779]
Acetone	(2-) 5-20	100-400; 2000[8]	550	(6-) 8-31	[11], [16, 17]
Acetonitrile			0.77	32	[11]
Acetyldigoxin[3]	see Digoxin				
Acetylfentanyl			0.23-0.27		[945-947]
Acetylmethadol	see Levacetylmethadol				
Acetylsalicylic acid (aspirin, ASS, ASA)	20-200[2]	300-350[2]	(400-) 500[2]	3-20[2, 37]	[28-34]
Acitretin	0.01-0.29 (-0.5)[112]			2-4 days	[35, 36], [948, 949]
ACNU	see Nimustine				
Acrivastine	-0.07			1-2	[8]
Acrylfentanyl			0.01-5 ng/g; 0.5-2.1 ng/mL		[950, 951], [1071]
Acyclovir	0.4-1.5[203]			2-5[83]	[3], [10], [37-39]
Adalimumab	≥ 4.9 (5-9)			appr. 14 days	[40], [787]
N-(adamantan-1-yl)-1-(5-fluoropentyl)-1H-indole-3-carboxamide	see STS-135				

Substance	Blood-plasma concentration (mg/L)			$t_{½}$ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Adipiodone(-meglumine)	850-1200			0.5	[41]
Adrenaline	see Epinephrine				
Adriamycin	See Doxorubicin				
Agomelatine	0.007-0.3[310]	0.6[311]		1-2	[4]
AH-7921			350 (30-9100) ng/mL[464]		[1011], [1041], [1071]
Ajmaline	(0.1-) 0.53-2.21 (?)		5.5[8]	1.3-1.6, 5-6	[3], [42], [952]
Albendazole	0.5-1.5[92]			8-9[92]	[43-46]
Albuterol	see Salbutamol				
Alcuronium	0.3-3[353]			3.3 ± 1.3	[47]
Aldrin	-0.0015	0.0035		50-167 days (as dieldrin)	[11], [48]
Alendronate (Alendronic acid)	< 0.005[322]			1-2; terminal: days[594]	[49-51], [999]
Alfentanil	0.03-0.6[6]		0.1-0.2	0.6-2.3[96]	[52-55], [1071]
Alfuzosine	0.003-0.06	0.12		3-9	[8], [780]
Alimemazine (Trimeprazine)	0.05-0.4	0.5	1-3.2	8	[56, 57]
Aliskiren	0.07-0.45[426, 620]			30-70	[47]
Alizapride	0.1-2			2-3	[15]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Allobarbital	2-5	10	20	40-48	[8], [11], [13], [58], [779]
Allopurinol[354]	2-19			0.5-3	[11], [47]
Almotriptan	0.05-0.07			3-4	[47]
Alogliptin	0.06-0.87			21	[780]
Alphaprodine	0.87-1			1.6-2.6	[11]
Alprazolam	0.005-0.05 (-0.08)[65]	0.1-0.4	0.3[252]	(6-) 12-15 (-20)	[4], [56], [59-63], [1231]
Alprenolol[48, 427]	0.025-0.14	1-2	40-48	2-7	[7, 8]
Aluminium	0.001 (< 0.005[234])	0.02-0.15	4.4[8]	160 days	[11], [47], [64-66], [953]
Amantadine	(0.06-) 0.2-0.6 (-1)	1.2[311]; 2.4[8]	21-48	9-15	[4], [47, 48]
5F-AMB (5F-AMB-PINACA)			0.3 ng/mL		[1037]
Amfebutamone	see Bupropion				
Amikacin	10-25[76]	30		(0.5-) 2-3	[67], [954]
Amiloride	0.017-0.026[620]			(6-) 17-24	[47]
Aminobenzoic acid	300-600	600			[66]
Aminoglutethimide	(0.05-) 7.5-25			10-15	[8], [11]
Aminophenazone	10-20			appr. 2-4	[15]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
5-(2-Aminopropyl)benzofuran (5-APB)	appr. 0.1		0.1-4.2		[781], [955]
5-(2-Aminopropyl)indole (5-API, 5-IT)		0.015-0.59	0.7-18.6 mg/kg		[956, 957]
4-Aminopyridine (Fampridine)	0.025-0.075	0.14[8]; 0.2		3-3.5	[10, 11], [68]
5-Aminosalicylic acid (5-AS, 5-ASA)	see Mesalazine				
Amiodarone[261]	(0.5-) 1-2 (-2.5)	2.5-3		30-120 days	[3], [64], [69-71]
Amisulpride	0.1-0.4	0.64[311]	9.3[8]; 41.7[8]	12-20	[4], [8], [72], [958]
Amitriptyline[7, 48] Amitriptyline + Nortriptyline	0.05-0.3 0.08-0.2	0.5-0.6 0.3[311]	1.5-2	(10-) 30-50	[4], [56], [73-83], [1084], [1231]
Amlodipine	0.003-0.015	0.088[8, 165]	0.1-0.2[8, 166]	34-50	[84-86], [780], [1064], [1151]
Ammonia	0.5-1.7				[11]
Amobarbital	1-5	(5-6) 10-30	13-96	15-30	[48], [87]
Amodiaquine	-0.05[270]			-[270]	[88]
Amoxapine	0.18-0.6[151]	3	5	8	[9]
Amoxicillin	0.5-1 (5-15)			1-2	[15]
Amphetamine	0.02-0.1	0.2	0.5-1	4-8 (7-34)[344]	[66], [89]
Amphotericin B	(0.1-) 0.2-3	(3-) 5-10	5.3[8]	24-48[110]	[47], [90-93]
Ampicillin	0.02-2 (2-20)			1	[67]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Amrinone	1-2 (-4)			3-12	[3], [94, 95]
Amsacrine	(0.1-) 1-5.5			5-7	[96]
Amygdalin (Laetrile)	see Cyanide				[130], [250-256], [788-793]
Anileridine	< 0.5		0.9[8]		[11], [48]
Aniline	-0.02[328] (urine)	0.13[8, 355]	6	(2-) 3-4 (-7)	[11], [47, 48], [97-99]
Antimony	-0.01[329]	0.05-0.2			[64], [100], [959]
Antipyrine	see Phenazone				
5-ABP	see 5-(2-Aminopropyl) benzofuran				
5-API	see 5-(2-Aminopropyl)indole				
Apixaban	appr. 0.03-0.3		0.39[8]	9-14	[794-797], [960]
Apomorphine	0.002-0.02[204]			appr. 0.75	[3], [10]
Aprindine[48]	1-2	2-3		13-50	[15], [58]
Aprobarbital	4-20	30-40	50	14-34	[11], [47], [58]
Aripiprazole[43] Aripiprazole + Dehydroaripiprazole	0.1-0.35 0.15-0.5	1[311, 345]	1.9[8]	60-80	[4], [101, 102], [798]
Armodafinil[607]	0.001-0.01[608]			10-20	[47], [780]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Arsenic	0.002-0.012 (-0.07)[283]	0.05-0.25	0.6-9.3 (-15)	10-14[633]	[11], [47], [64], [87], [100], [103], [799], [1230]
Articaine	< 1.5-2 (?)			0.3 (-1)	[104]
Ascorbic acid (Vitamin C)	4-15			days	[3], [105-108], [800]
Asenapine	0.001-0.005	0.01[311]		13-39	[4]
Aspirin	see Acetylsalicylic acid				
Astemizole	0.002-0.05[43]	14[8]		2-4 days[42]	[3], [109], [961]
Atazanavir (ATV)	> 0.15[293]			(4-) 6.5-8.6 (-11)	[2], [47], [110, 111]
Atenolol	0.1-1 (-2)[77]	2-3	27[8]	4-14[9]	[7], [42], [64], [112]
Atomoxetine	0.2-1[317]	2[311]	5.4[8]	appr. 4[356]	[4], [962]
Atorvastatin[542]	0.007-0.01 (-0.25)	0.05		11-24	[47], [780], [1063]
Atovaquone	13.9 ± 6.9 (> 15)			2-3 days	[113]
Atracurium(besylate)	0.1-0.5 (-5)			appr. 0.5	[47], [58]
Atropine	0.002-0.025[155]	0.03-0.1	0.2	2-6.5, 13-38	[11], [66], [114]
Avanafil	-[428]			6-20	[47]
Avobenzone	0.001-0.009[419]			(29-) 74-112 (-480)	[801], [1122]
Azapropazone (Apazone)	40-90			8-24	[8], [13]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Azathioprine[10]	0.05-2			1-2 (-4)[11]	[13], [15], [123]
Azelastine	0.002-0.003 (-0.01)			22-25	[15]
Azelnidipine	< 0.03 ?			(9-) 14-20	[802, 803]
Azilsartan medoxomil[429]	appr. 4-5[620]			12-20	[47]
Azithromycin	appr. 0.04-1			50-60 (2-4 days)	[115-119]
Aztreonam	1-10 (50-250)			1.5-2	[11]
Baclofen	0.08-0.4 (-0.6)	1.1-3.8	6-9.6	6.8 ± 0.7 (2-8)	[9], [11], [47], [804]
Bambuterol	see Terbutaline				
Barbexaclone	active metabolite = Phenobarbital (see there)				[12]
Barbital	2-20	20-50	50	57-120	[13], [15]
Barium	-0.001		0.37; 16-23[8]	10-18	[47]
BDF	See Bromobenzo-difuranylisopropylamine				
Benazepril	0.003-0.007			10.5	[780]
Bendrofluazide	0.05-0.1			appr. 3	[42]
Bendroflumethiazide	0.02-0.09[430, 620]			2.4-3.8	[47], [1152]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Benoxaprofen	-50			19-39	[3]
Benperidol	0.001-0.01	0.02[311]		4-8	[4], [8]
Benzbromarone	2-10			2-4	[927, 928]
Benzene	-0.0002[271]		0.95[8]	9-24	[47], [58]
Benzhexol	see Trihexyphenidyl				
Benzonatate		2.5	0.8[8]; 4-35[8]	appr. 1-3	[8], [47], [963]
Benzoylecgonine[357]	-0.1		1	4-5	[8]
Benzphetamine	0.025-0.5	0.5	14[8]		[8], [11], [47]
Benztropine	0.01-0.18	0.05	0.2-0.7	12-24	[8], [11], [47]
Benzydamine	-[563]			6-23 (oral); 14-35 (topical)	[47]
Benzyl alcohol	-[431]	18[8, 194]		-[195]	[3], [47], [120, 121]
Benzylpenicillin	1.2-12			1	[41], [67]
N-Benzylpiperazine	0.01-1.2	0.7-6.3	8.3-20	4-6	[47]
Bepridil	0.6-2.5			33-42 (30-130)	[8], [122]
Beryllium	-0.0003				[58]
Betacarotene	4-6[196]				[3], [124]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Betaxolol	0.005-0.05		36[8]	14-22	[7], [47], [125]
Bethanidine	0.02-0.5			9-10	[3], [58]
Bevantolol	0.2-2			2	[8]
Bezafibrate	-15			2	[3]
Bicalutamide	1.5-17.5 (-25)[163]			(3-) 7-10 days	[126]
Biperiden	0.001-0.0065[406]	0.013[311]	0.25[8]	18-24	[4], [56]
Bismut (Bismuth)	< 0.05 (-0.1)	0.05-0.1		days	[47], [64]
Bisoprolol	0.01-0.1	0.2	0.17[8]	10-12	[7], [780], [964], [1064]
Bopindolol	0.001-0.015[54]			4-8[54]	[7], [965]
Borate	0-7	20	200	12-27	[47], [66]
Boron	0.8-6	20-50	50-150		[58]
Bornaprine	0.0007-0.0072[313]	0.014[311]		appr. 30	[4]
Bosentan	0.7-1.6[620]			3.5-5.1	[47]
Brallobarbital (Brallobarbitone)	4-8	8-10	15	20-40	[8], [13]
Bretylium	0.8-2.4			6-11	[3], [58]
Brexiprazole	0.04-0.14	0.28[311]		91	[4]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Brivaracetam	0.5-0.9	1.8[311]		7-11	[4]
Brodifacoum		0.02	0.03-0.17; acute: 3.9[8]	20-60 days	[58], [127]
Bromadiolon		0.02		3-6 days (early), 10-24 days (late phase)	[11], [47], [58]
Bromazepam	(0.05-) 0.08-0.2	0.3-0.4	(1-) 2	8-22 (-35)	[4], [59]
Bromide	75-100 (-300)	500-1500; 3000[8, 242]	2000	9-15 days	[47], [58], [128-130]
Bromisoval	10-20	30-40		appr. 4[28, 105]	[13], [58]
Bromobenzodifuranylisopropylamine (Bromo-DragonFLY, BDF)		0.5-2 ng/mL	4.7 ng/mL[8]		[967, 968]
Bromocriptine	0.1-0.3 (-4) ng/mL[314]	8 ng/mL[311]		appr. 38	[4]
25B-NBOMe (2-(4-bromo-2,5-dimethoxyphenyl)-N-[(2-methoxyphenyl)methyl]ethanamine)		0.038	0.06-0.66		[966]
Bromoxynil		20	79[8, 433]; 137[8, 432]		[58], [969]
Bromperidol	0.012-0.02	0.03[311]		20-36	[4]
Brompheniramine	0.005-0.015	0.2[8]		2-10 (-20)	[15], [47]
Brotizolam	0.001-0.01 (-0.02)	0.02[311]	0.01-0.03[8]; 0.21	4-10	[4], [47], [131], [970]
Budesonide	appr. 0.009-0.045			2-3	[780]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Budipine	appr. 0.1-0.3			30	[15]
Buflomedil	appr. 0.2-0.5 (-1.0)	15-25	25-50; 275[8]	2-4	[11], [42], [58]
Bumetanide	0.001-0.005			0.8-1.5	[780], [1205]
Bunitrolol	0.001-0.015			2-6	[7]
Bupivacaine	(0.25-) 0.5-1.5 (-2)	2-4	3.8[8]	0.5-3	[3], [132-134], [971]
Bupranolol[44]	-[434]			2-4	[7], [972]
Buprenorphine[340]	0.0005-0.005 (-0.014)[285]	0.01[311]; 0.03-0.1[339]	0.008-0.029	2-5 (i.v.); 18-49 (sublingual); appr. 19 (buccal)	[3, 4], [47], [135-141], [1006]
Bupropion (Amfebutamone)	0.01-0.02; 0.05-0.1[152]; 0.55-1.5[435]	1.2-2[246]; 2[311]	4[8]; 4.2[8]; 7.3[8]	(4-) 10-20; 17-47[436]	[4], [47], [80], [142-148], [973]
Buspirone[312]	0.001-0.004 (-0.01)[437]	0.03[311]	0.2 (0.05-1.1)[465]	1-5 (4-7)[438]	[4], [1012], [1194]
Busulfan	> 0.9[291]			2-4	[149-154]
Butabarbital	see Secbutabarbital				
Butalbital	1-5	10-15	15-30	30-40	[13], [15], [58]
1,4-Butanediol[466]	see 4-Hydroxybutyrate				[1013]
Butanone	-10	500			[58]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Butaperazine	0.02-0.3 (-0.7)			12	[15], [779]
Butorphanol	0.0006-0.002			4-9	[8], [779]
Butriptyline	0.07-0.15	0.4-0.5	15	18-22	[15], [47], [779]
Butylone		0.2	0.13-129		[955], [1014, 1015]
Butylscopolamine	-0.7			4-5	[8]
Buturylfentanyl			99 ng/mL		[974], [1071]
Cabergoline	0.058-0.144 ng/mL[315]	0.39 ng/mL[311]		63-68	[4]
Cadmium	< 0.0003-0.0065	0.015-0.05		appr. 16 years	[47], [58], [100]
Caffeine (Coffein)	(2-) 4-10	15-20	80-180	2-10	[47], [64], [155-157]
Calcifediol (Calcidiol; see also Vitamin D)	0.01-0.05				[66]
Camazepam	0.1-0.6	2		20-24	[59]
Camostat[631]	87.1 ± 29.5 ng/mL[632]			100 ± 40 min[632]	[1227, 1228]
Camphor		0.3-0.4	1.7	2-8	[8], [47], [158]
Canagliflozin	0.17-1.3			(8-) 10-12 (-15)	[47], [780]
Candesartan	0.08-0.18 (-0.4)	0.54		5-7, 8-13	[15], [47], [780], [1064]
Canrenone	see Spironolactone				

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Captopril	0.05-0.5 (-1)[620]	5-6	60	1-2 (-6)	[42], [47], [84], [159]
Carazolol[23]	-0.015			9	[7]
Carbachol	appr. 0.01 ?		3.6[8, 287]		[3], [160]
Carbamazepine[12]	2-8 (4-12)	10	20	12-60 (7-35)[140]	[12], [56], [161-166], [1231]
Carbaryl		5	6-27		[47], [167]
Carbenoxolone	appr. 5-30			8-20	[66]
Carbidopa	0.02-0.2[316]	0.4[311, 316]		2	[4]
Carbimazole	0.5-3.4[95]			3-6[95]	[8], [13]
Carbinoxamine	appr. 0.02-0.04			appr. 10-15	[168]
Carbocromene (Carbochromene)	0.8-2.4 (-3)			0.2-1.5	[8]
Carbon monoxide	-[200]	17-30%	50-60%		[10], [47], [58], [975-978]
Carbon tetrachloride	-0.07	0.12[8]; 7.1[8, 269]; 11[8]; 10-50	100-200	appr. 24; 42.6[8]	[58], [169-173]
Carboplatin	peak 10-25			2.5-6[106]	[47]
Carbromal(um)[13]	2-10	15-20	40	7-15	[13], [58]
Carfentanil			0.12[8]; 0.145[8]; 0.221[8]; 1.3[8] ng/mL		[979, 980], [1071]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Cariprazine[439]	0.01-0.02	0.04[311]		48-120	[4], [47]
Carisoprodol[440]	2.5-10	40; 30-50[104]	8-65[8, 441]; 110[104]	0.9-2.4	[47], [56], [58], [982]
ß-Carotine	see Betacarotene				
Carteolol	0.01-0.1			3-7	[7]
Carvedilol	appr. 0.02-0.15 (-0.3)	0.47[8]		6-10	[3], [8], [95], [983]
Cathine	0.054-0.087[370]; 0.11-0.2[442]; 0.016-0.31[553]			1.8-8.6	[984, 985]
Cathinone	0.047-0.087[370]; 0.009-0.17[554]			0.7-2.3	[984, 985]
Cefaclor	13-35 (i.v. -900)			0.5-1 (-2)	[3], [8], [11]
Cefadroxil	-30			1-2	[8]
Cefalexin	-65			1-1.5	[41]
Cefaloridine	20-80			1.5	[41]
Cefalotin	see Cephalotin				
Cefamandole	1-5 (10-40-150)			0.5-1.2	[41], [58]
Cefazolin	-150			1.5-2	[8], [41], [67]
Cefdinir	-4			1.1-2.3	[8], [47]
Cefepime	-160			2	[8]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Cefetamet	-7			2-3	[8]
Cefixime	-7			3-4	[8]
Cefmenoxime	-200			1-2	[8]
Cefodizime	-400			2-4	[8]
Cefoperazone	-250			1-2 (-5)	[8], [174]
Cefotaxime	0.5-2 (10-50; i.v. -225)			1-1.5	[67]
Cefotetan	65-90			3.5	[41]
Cefotiam	-150[71]			0.7-1.5 (-2)	[41], [175]
Cefoxitin	-150			0.7-1	[41]
Cefpodoxime	-7			2-3	[8]
Cefsulodin	20-100			1.6-1.9	[3], [8], [11]
Ceftazidime	20-40 (50-200)			1-4	[3], [8], [11]
Ceftibuten	appr. 3-20			2-4	[8]
Ceftizoxime	40-160			6-9	[41]
Ceftriaxone	15-75			4.5-8.5	[67], [1186]
Cefuroxime	0.5-1 (10-60; i.v. -180)[243]			1.1-1.3	[3], [10], [58], [176, 177]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Celecoxib[48]	0.36-0.8[371]			7-16	[47]
Celiprolol	0.05-0.5 (-1)			3-6	[58]
Cephalothin (Cefalotin)	-30			0.5-0.6	[3], [41]
Cerivastatin	0.002-0.04			1.5-3	[8]
Cetirizine	appr. 0.1-0.6	2-5		7-10	[15], [47]
Chinidine	see Quinidine				
Chinine	see Quinine				
Chloralhydrate[14]	1.5-15	40-50	60-100	6-10 (-30)	[47], [58]
Chlorambucil	0.15-0.3			1.5-3	[15]
Chloramphenicol	5-10 (-15)[59]	25	28-108; 180[8, 552]	2-6	[11], [47], [58], [178], [1069]
Chlordane	-0.001	0.0025	1-7	88 days	[11], [58]
Chlordecone		0.6-32		63-148 days	[47]
Chlordiazepoxide[15]	0.4-3	3.5-10 (-15); 20.5[8]	20[8]; 26[8]	6-27	[11], [47], [56], [58], [179, 180]
Chlorhexidine				appr. 12 (dermally in rats)	[47]
Chlormethiazole	see Clomethiazole				

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Chlormezanone	(3-) 5-9 (-14)	appr. 20	18[8]; 53[8]	20-30 (-60)	[43], [47], [56], [181]
Chlorobutanol		75			[66]
2-(4-chloro-2,5-dimethoxyphenyl)-N-[(2-methoxyphenyl)methyl]ethanamine	see 25C-NBOMe				
Chloroform	20-50 (-100)[443]	appr. 70	33[8]; 64[8]; 69[8]; 91[8]	1.5	[11], [47], [58], [182]
Chlorophacinone			3.4-28; 26[8]	6-23 days	[47]
Chloroquine	0.02-0.5 (-0.7)	0.8-1	3; 8[8]; 15[8]; 18[8]	dose-dependent (3-14 (-30-60)) days	[30], [47], [56], [183], [806], [1232]
Chlorothiazide	2-18			0.5-2	[3], [11], [58], [780]
Chlorphenamine (Chlorpheniramine)	(0.003-) 0.01-0.02		1.1[8]	(12-) 15-25 (-43)[358]	[3], [11], [47], [58]
Chlorpromazine[66]	0.03-0.1 (-0.5)	0.6[311]; 1-2	3-4	10-30	[4], [56], [184, 185]
Chlorpropamide	30-250	200-750		25-60	[58], [66]
Chlorprothixene	0.02-0.3	0.4[311]	0.4-0.9	8-12	[4], [47], [798]
Chlorpyrifos		0.2	0.5 (0.14-1.2)[276]	56-74	[47], [186]
Chlortalidone	0.15-0.3 (-1.4)	appr. 2		44-48 (24-89)	[47], [58]
Chlortetracycline	1-5 (-10)	30		5-6	[9], [13, 14], [58]
Cholecalciferol	see Vitamin D				

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Chromium	< 0.0005[388]	0.001-0.091 (-0.3) (inhalative exposition); 0.2-4.6 (after oral intake)	1[555]; 32[8]; 68[8]	3-4 years	[47], [805], [987]
Cibenzoline	0.2-0.4 (-0.9)	(0.5-) 1	3.4-23	(6)- 7-8 (-15)[83]	[3], [47], [187]
Cicletanine	appr. 1-2			5-23	[3], [8]
Ciclosporine A (Cyclosporine, CsA)	< 0.1-0.25	0.3-0.4[16]		10-27[169]	[188-193]
Cidofovir	appr. 7-43			2.5	[3], [8]
Cilazapril (Cilazaprilat)	0.003-0.09			30-50	[8]
Cilostazol	0.18-0.54			12	[780]
Cimetidine	0.25-3 (0.75-4)	19-50	110[8]	1.5-4	[47], [58], [194, 195]
Cinnarizine	0.04-0.33	7.4[8]	1.1[8]	12-34	[47]
Cinoxacin	appr. 15			1.5-4	[8]
Ciprofloxacin	2.5-4	11.5[8]		3-6 (-8)	[47], [196-199], [203]
Cisaprid	0.04-0.08			6-12	[8]
Citalopram	0.05-0.11	0.22[311]; 2.45[8]	3.4-10.5 (5-6[160])	25-48[170]	[4], [8], [47], [56], [200-202], [204-207], [807, 808], [1084]
Cladribine	appr. 0.006			0.1-0.2 (6.4-19.7)	[208-210]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Clarithromycin	appr. 0.2-2			3-7[217]	[8], [115], [118], [211-213]
Clemastine	appr. 0.001-0.002			10-32	[8], [47], [214]
Clenbuterol	0.0003-0.0006	0.003[8]	0.001[8, 424]	30-35	[47], [940-942]
Clindamycin	appr. 0.5-2[556]			2-3	[8], [47]
Clobazam[17]	0.03-0.3	0.5[311]	0.7[8, 444]; 3.9[8]	18-42	[4], [47], [59], [215]
Clobutinol	appr. 0.05-0.2			23-34	[3], [8]
Clodronate (Clodronic acid)	0.7-1[460]			(2.5-) 7-8; terminal: days[594]	[49], [996, 997]
Clofibrate	50-250			10-18	[88]
Clomethiazole (Chlormethiazole)	0.1-5[446]	(2.8-) 4-15	10-214	(2-) 3-5 (-7)	[4], [9], [13], [47], [216, 217]
Clomipramine[48, 85] Clomipramin + N-Desmethylclomipramin	(0.02-) 0.09-0.25 (-0.4)[226] 0.23-0.45	0.4-0.6 0.45[311]	1-2	16-60	[4], [76], [80], [218-223], [1084]
Clonazepam	(0.004-) 0.02-0.07[150]	0.08[311]; 0.1		20-60	[4], [60], [161], [224]
Clonazolam	-[421]	-[421]			[835]
Clonidine	0.001-0.002 (-0.004)	0.009[8]; 0.025-0.05	0.023[8]; 0.23[8]; 5.2[8]	5-20	[47], [225-227]
Clopamide	appr. 0.06-0.18[620]			6-14	[47]
Clopenthixol (Clopentixol)	0.002-0.015	0.1-0.3		15-25	[8], [11]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Clopidogrel[445]	0.001-0.006			1.5-4 (-7)	[47]
Clorazepate[15]	see Nordazepam			1-2	[164]
Clotiapin	0.007-0.15	0.12-0.38	0.3[8]; 1.3[8]	4-10	[47]
Clotiazepam	0.1-0.7			3-15	[8]
Cloxacillin	5-30 (-85)			0.5-1 (0.3-2)	[8], [11], [58]
Clozapine[136]	(0.1-) 0.35-0.6	0.6-1 (9.5[8])	1.2[8]; 2[8]; 5.2[8]	(6-) 12-16	[4], [72], [101], [228-240], [809]
25C-NBOMe (2-(4-chloro-2,5-dimethoxyphenyl)-N-[(2-methoxyphenyl)methyl]ethanamine)		0.16 ng/mL[8, 447]	0.8 ng/g[8, 448]		[47], [988, 989], [995]
Cobalamin	see Vitamin B_{12}				
Cobalt	0.0001-0.001	0.4-0.5	0.42[8]	2 (early); 38 (late phase)	[11], [47], [58]
Cocaine	0.05-0.3	(0.25-) 0.5-1 (-5.2)	0.9-21	0.5-1[18]	[13, 14], [47], [58], [241, 242], [990], [1083]
Codeine[48]	0.03-0.25	0.5-1[339]	0.45-2 (-48)	3-4	[3], [47], [243, 244]
Coffein (Coffeine)	see Caffeine				
Colchicine	0.0003-0.0025	0.005 (0.019[8])	0.009[8]; 0.024[8]; 0.066[8]	11-32 (-60)[143]	[10], [47], [245-248]
Colecalciferol	see Vitamin D				

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Colistin	1-5[86]			1.5-2 (-5)	[47]
Copper	0.6-1.5	0.8-2	2.5-5 (-66)	26 days	[66]
Cotrimoxazole	see Sulfamethoxazole and Trimethoprim				
Coumatetralyl		0.009[8]; 0.12[8]		12-13[452]	[47], [249]
Cresol (Methylphenols)	-[449]	appr. 50	120		[58], [991]
Cromolyn (Cromoglycate)	appr. -0.01			1-1.5	[3]
5F-Cumyl-PEGACLONE			0.09-0.45 ng/mL[8, 565]		[1081, 1082]
Cyamenazine	0.0009-0.016		1.8[8]; 3.6[8]; 9.8[8]	10-12	[47]
Cyanide	-[177]	(0.2-) 0.5; 0.514[8]	1-3	0.7-2.1 (whole blood); appr. 19[184]	[47], [130], [250-256], [788-793]
Cyclizine	0.1-0.25	0.75-1	15; 16[8]	7-24	[11], [47], [58], [810]
Cyclobarbital	2-6	10	20; 68[8]; 70[8]	8-17	[811, 812]
Cyclobenzaprine	appr. 0.003-0.04	0.4	0.8; 1[8]	18 (9-40)[253]	[11], [58], [257], [992]
Cyclohexane	-0.4[450]			1-3	[47]
1-Cyclohexyl-4-(1,2-diphenylethyl)piperazine (MT-45)	-		0.52[8, 559]; 2.9[8,451]		[993], [1070]
Cyclophosphamide	10-25			(1.3-) 4-8 (-16)	[3], [8]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Cyclopropane	80-180				[11], [58]
Cyclopropylfentanyl[411]	-		1.4-43[412]; 51[8]; 76[8] ng/mL		[813-816], [1015], [1071]
Cyclosporine	see Ciclosporine				
Cyproheptadine	appr. -0.05	0.13[8]	0.47[8]	8-9; 20-40	[3], [47]
Cyproterone acetate	0.01-0.2			30-40 (-120)	[47], [126]
Cysteamine	appr. > 1.55[282]			appr. 1	[3], [258]
Cytarabine	0.05-0.5			0.1-0.2 (1.9-2.5)	[9], [209]
2,4-D	see 2,4-Dichloro-phenoxyacetic acid				
Dabigatran	(0.03-) 0.04-0.2 (-0.3)	0.2?; 2.7[8]	5.6[8]	9-14[83]	[794], [796, 797], [817-820], [960]
Dalfampridine	0.015-0.055			5.8	[780]
Danazol	appr. -0.2			4.5	[3]
Dantrolene	(0.1-) 0.4-1.5 (-3)			4-12	[3], [9], [259]
Dapagliflozin	0.006-0.285			12.9	[780]
Dapsone[48]	0.5-2	10	18[8]	25-31	[260, 261]
Daptomycin	> 3.2 (trough)	24.3 (trough)		(4-) 7-9 (-12)	[821-825], [1186]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Darifenacin	0.0015-0.02			16	[780]
Darunavir (DRV)	> 3.3 (1.3-7.4)[301]			appr. 15	[2], [110], [262]
DEET	see N,N-Diethyl-3-methylbenzamide				
Deferoxamine (Desferrioxamine)	3-15			4-6	[8], [47]
Delorazepam[557]	0.01-0.07			80-115	[47]
Demoxepam	0.5-0.74	1	2.7		[66], [1194]
Desipramine[48,69]	0.01-0.5 (0.1-0.3)	0.3[311]; 0.5-1	3	15-25[70]	[4], [74], [78-80], [263, 264]
Desloratadine[372]	0.002-0.006[373]	0.012[311]		17-27	[4]
Desmethyldiazepam (N-Desmethyldiazepam)	see Nordazepam (= Nordiazepam)				[59]
Des(methyl)venlafaxine	0.1-0.4	0.8[311]		10-17	[4]
Detajmium	0.01-0.7		1.8[8]	13-14	[8]
Dexamethasone	appr. 0.05-0.27[247]	0.8		2.5-9.5	[3], [265]
Dexfenfluramine[351]	appr. 0.03-0.06	0.15-0.25		appr. 18	[11], [58], [66]
Dexketoprofen[374]	appr. 3.7			0.5-2	[47]
Dexmedetomidine	-appr. 3.5 ng/mL[469]			3-10	[47], [1017]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Dexmethylphenidate[342]	0.013-0.023[318]	0.044[311, 318]		appr. 2	[4]
Dextromethorphan[48]	0.001-0.04 (0.23[458])	0.1-2.8	1.1-3 (-20)	2-4 (23-42[458])	[47], [266-270]
Dextromoramide[350]	0.05-0.15	0.2[339]	0.1-1.5	1.5-4-7	[8], [47], [58], [271, 272]
Dextropropoxyphene[305]	0.05-0.3 (-0.5)	0.6-1	1-2	10-30	[30], [48]
Diacetylmorphine or Diamorphine (DAM)	see Heroin (and Morphine)			2-5 minutes	[273-281]
3,4-Diaminopyridin (DAP)	< 0.04[213]	0.1 (?)		0.3-2[214]	[282]
Diazepam[19]	0.1-2 (-2.5)[459]	3[311]-5[459]		24-48	[4], [13, 14], [59], [224], [241], [283-286]
Diazinon	-	0.05-0.1 (-0.5)	0.7-277		[47], [58]
Diazoxide	10-20 (-50)	50 (-100)		20-36 (-48)	[3], [10], [42], [58], [84]
Dibenzepine	0.025-0.15 (0.1-0.5)	3[359]	18[359]	3.5-5	[11], [58]
Dichloromethane	-		50-280 (-2200)	0.6 (early); 4-8 (late phase)	[47]
2,4-Dichlorophenoxyacetic acid (2,4-D)	-	appr. 100	200; 392[8]; 720[8]	4-140[182]	[3], [11], [47], [58]
Dichlorprop	-	52[8]	250[8]; 450[8]	70-90	[47]
Dichlorvos (2,2-Dichlorvinyl-dimethyl-phosphate, DDVP)	-		29	0.16	[47]
Diciclomine	see Dicyclomine				[8]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Diclazepam[421]	-[468]				[1016]
Diclofenac	0.5-3	50; 60[8]		1-3	[47], [287-289]
Dicoumarol	8-30	22-192		1-4 days	[8], [11]
Dicyclomine (Dicycloverin)	-0.1	appr. 0.2	0.2[8]; 0.5[8]	1.8-2 (-5)	[8], [47]
Didanosine (DDI)	appr. 1-30 µmol/L			appr. 1.4	[2, 3], [38], [290, 291]
Dieldrin	-0.0015	0.15-0.3	0.5	2-12 months	[11], [47], [58]
Diethylcarbamazine	> 0.8-1.0			4-15	[292]
Diethylene glycol	-	0.04[8, 453]; 17[8, 454]; 200-500	0.2[558]-360[455]	3-4	[47]
N,N-Diethyl-3-methylbenzamide (N,N-Diethyl-m-toluamide; DEET)	-	1.6	112[8]; 240[8]	appr. 2.5	[47]
Diethylpentenamide (Valdetamide)	2-10	20	45	6-7	[8], [13]
Diethylpropion	0.003-0.007 (-0.2)	2	5.4[8]	4-8[23]	[3], [8], [58]
Difenacoum	-	0.5		11-42 days	[47]
Diflunisal	40-100 (-200)	300	260[8]; 370[8]; 520[8]	5-12[83]	[3], [9], [47], [58], [293]
Digitoxin	0.008-0.018	0.03	0.04	140-200 (7-9 days)	[294, 295], [783]
Digoxin	0.0005-0.0009	(0.0012-) 0.002[383]	0.004-0.005	40-70	[18-27], [782-786]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Dihydralazine	see Hydralazine				
Dihydrocodeine	0.03-0.25	0.5-1 (-12)[339]	0.4-166	3-4	[14], [47], [58]
Dihydroergotamine	0.001-0.01			4-15	[3], [8], [47]
Diltiazem	0.03-0.13 (-0.25)[157]	0.8-1	2-6; 7[8]; 8[8]	2-6 (4-9)	[3], [47], [58], [84]
Dimenhydrinate	see Diphenhydramine				
Dimethadione[360]	(350-) 700-1000	1000		5-10 days	[3], [8], [11, 12]
Dimethindene	0.01-0.05			appr. 6	[3], [8]
Dimethoate	-		355.5 (160.0-674.0) µmol/L[277]	appr. 5	[47], [186]
2,5-Dimethoxy-4-bromoamphetamine (DOB)			0.01[8]; 0.02[8]; 0.9[8]	17-22	[47]
2,5-Dimethoxy-4-bromophenethylamine (2C-B)		0.34[8]		1.1	[47], [994]
3,4-Dimethylmethcathinone (3,4-DMMC)				27[8]	[1018]
N,N-Dimethyltryptamine	0.001-0.1			0.5-1.5	[47], [58]
4,6-Dinitro-2-methylphenol (Dinitro-O (ortho)-cresol [DNOC])	1-5	30-60	34[8]; 75[8]	5-6 days	[47], [58]
Dionin	see Ethylmorphine				

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Diphenhydramine	0.05-0.1 (-1)	(0.1-) 1-2 (-4)	1.1 (in infants); 5-10	3-14, 20-60	[47], [58], [114], [296, 297]
Diphenidine			0.012-1.38[470]		[1015]
Diphenoxylate	appr. 0.01-0.08		0.34[8]	2-3	[47]
Dipipanone	appr. -0.05	0.43	< 0.1 (oral); 0.5-6.2 (i.v.)	3.2-3.8	[47]
Diprophylline	see Dyphylline				
Dipyridamole	0.1-1.5 (-2)	4	9.2[8]; 187[8]	(6-) 11-13 (-28)	[9], [13, 14], [47]
Dipyrone	see Metamizole				
Diquat	-	0.1-0.4	0.4-4.5; 65[8]		[11], [47]
Disopyramide	2-7[78]	8	27	(3-) 5-8 (-11)	[11], [47], [58], [64], [70], [986]
Disulfiram	0.05-0.4	0.5[311]; 5	8[456]; 120[456]	5-9	[4], [47], [58]
Divalproex	see Valproic acid			(9-) 12.5 (-16)	[780]
Dixyrazine	appr. 0.3[249]		5.5[8]; 9.4[8]		[4], [298]
DOB	see 2,5-Dimethoxy-4-bromoamphetamine				
Dofetilide	0.002-0.0055			(5-) 9-10 (-13.5)	[780]
Domperidone	appr. 0.01-0.1	0.2[311]		12-16	[3], [299-302]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Donepezil[207]	appr. 0.03-0.075	0.1[311]		70-100	[4], [303, 304]
Doripenem	appr. -12			(1-) 2.5-8	[826], [1186]
Dothiepin (Dosulepin)[20]	0.045-0.1	0.2[311]; (0.3-) 0.8	0.3-5.8	(8-) 11-20 (-40)	[4], [47], [305, 306]
Doxacurium	0.01-0.3			1-2[83]	[8]
Doxapram	(1.5-) 2-5	9[268]		2.4-9.9	[3], [11], [58], [307]
Doxazosin	0.01-0.15	0.3[311]		10-22	[47], [95]
Doxepin[21] Doxepin plus N-desmethyldoxepin	0.01-0.2 (0.03-0.1) 0.05-0.15	0.5-1 0.3[311]	2-4	(8-) 15-20 (-25)	[4], [73], [77], [80], [264], [308-310]
Doxorubicin (Adriamycin)	0.006-0.02			20-48	[3], [8], [58]
Doxycycline	1-5 (-10)	30		15-28	[8], [58]
Doxylamine[289]	0.05-0.2[457]	0.32[311]; 1-2	5	(7-) 9-11 (-13)	[4], [47], [87], [311], [827]
Dronabinol (Delta-9-tetrahydrocannabinol, THC)	0.005-0.01 (-0.05)[137]			50-100	[241], [312, 313]
Dronedarone	0.084-0.167[398]			24-30	[780], [828]
Droperidol	appr. -0.05			1.5-2.5[237]	[3], [314]
Drotrecogin alfa	mean 0.072			1.6	[315]
Duloxetine	0.03-0.12	0.24[311]		9-19	[4], [223]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Dutasteride	0.025-0.055			4-5 weeks	[780]
Dyphylline	6.5-14 (-20)	40		2	[11], [58]
Ecamsule (Mexoryl SX)	0.0005-0.012[419]				[801]
Ecdysterone	appr. -0.008				[829], [1066]
Edoxaban	0.02-0.1	0.15 (-0.2)[402]		(6-) 10-14	[47], [794], [797], [830], [960]
Edrophonium	0.15-0.2	appr. 0.15		1.3-2.4	[3], [58], [316]
Efavirenz (EFV)	> 1.0 appr. -3[297]	6[311]		40-55	[2], [110, 111], [780]
Eletriptan	0.06-0.23			3-7	[47]
Embutramide			2-90	9.6	[47]
Emetine	(0-)[472] 0.005-0.075	0.008-0.5	2.4[8]	10-18; 24-48	[8], [47]
Empagliflozin	0.03-0.36			9-10	[780]
Emtricitabine				appr. 10	[780]
Enalapril[52]	0.01-0.05 (-0.1)	0.3	2.8[8]	(6-) 8-11 (-55)	[47], [84], [159]
Encainide[48]	-[175]			1.5-3.5[176]	[3]
Endrin	-0.003	0.01-0.03	0.62[8]		[47], [58]
Enflurane	44-144[473]		130[8]; 710[8, 474]	36[560]	[47]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Enfuvirtide	2.6-3.4			3-4	[47], [1001]
Enoxacin	1-4[475]			3-6	[47], [197], [1019]
Enoximone	≥ 0.2 (3-4 ?)			4-7	[3], [8], [95]
Enprofylline	1-5	10		appr. 2	[8]
Entacapone	0.4-1.0 (-7.0)	2[311]		(0.5-) 1.5-3.5	[3, 4], [8]
Enzalutamide[568]	appr. 19-25 (-30)[391]			appr. 6 (3-10) days	[831, 832], [1086]
Eperisone	appr. 0.0007-0.008[476]	0.16-4.1	15.3[8]	1-4	[47]
Ephedrine	0.02-0.2	0.15[8]; 1; 15[8]; 22[8]; 23[8]	2.7[8]; 5[8]; 3.5-21[471]	3-11	[8], [47], [57, 58], [87], [269]
Epinephrine (Adrenaline)	appr. 6.8 ng/L[478]		60 ng/L[8, 561]	0.7[477]	[47], [1073]
Epirubicin	appr. (0.05-) 0.2-3			10-45	[47], [1000]
Eplerenone	appr. 1-1.7[479, 620]			3-6	[47]
Eprosartan	0.4-1.0 (-1.85)			5-9	[3], [8]
Eptastigmine	0.0002-0.006			appr. 1	[8]
Eptinezumab				26-28 days	[1102]
Erenumab	appr. 10-25 ?			21-28 days	[1102], [1105, 1106]
Ergotamine	0.36-0.42 ng/mL[375]	0.82 ng/mL[376]		1.5-2.5	[47]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Ertapenem	appr. -100 (total[410])			3.5-7[409]	[825], [833, 834], [1186]
Erythromycin	0.5-6 (peak 4-12)	12-15		1-3	[11], [58]
Escitalopram[343]	0.015-0.08	0.16[311]		26.3 ± 10.8 (27-32)	[4], [223]
Eslicarbazepine acetate[480]	10-35	70[311]		20-40	[4]
Esmolol	0.15-2			4-16 minutes	[7]
Esomeprazol	appr. 0.6-6.6			0.6-1.4	[47]
Estazolam	0.055-0.2		0.48[8]; 1.25[8]	10-24	[3], [47], [58]
Eszopiclone[341]	appr. 0.01-0.09	0.15		4-9	[47], [780], [935]
Etacrynic acid (Ethacrynic acid)	0.05-0.1			1-4	[3], [8, 9]
Etamsylate (Ethamsylate)	15-20			2.5-4	[13, 14], [58]
Ethadione	500-1000	1000			[8]
Ethambutol	(0.5-) 3-5 (-6.5)	6-10	84[8]	2.5-3.5; 6-15	[47], [58], [317]
Ethanol		1000-2000	3500-4000	-[139]	[13]
Ethchlorvynol	0.5-8	20	50	10-25 (-35)	[3], [58]
Ethinamate	1.5-10	50-100	200[8]	appr. 2	[8], [13]
Ethosuximide	30-100 (40-60)	120[311]; 150-200	250	30-60	[4], [12], [64], [161], [164]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Ethyl chloride	-		36[8]; 200/650[481]		[47]
Ethylene glycol		200-500	2000 (500-7750)	3-4 (rats); 2-3[482]; 14.2-19.7[483] (31[8, 278])	[47], [66], [318-326], [1020, 1021]
Ethylmorphine[48] (Dionin)	0.3-0.6[339, 377]		0.05[8]; 0.3-2.9[339]	2-3	[47]
Ethylone (3,4-Methylenedioxy-N-ethylcathinone, = MDED, bk-MDEA)				1.7[8]; 0.038-2.57[484]	[1022]
Ethylphenidate				0.026-2.18[485]	[1023]
Etidocaine	0.5-1.5	1.6-2		2-3	[327]
Etilefrine	appr. 0.06			2-3.5	[1002], [1053-1054]
Etizolam[48]	0.008-0.018[421, 486]	0.03[8]	0.26[8]	2-3	[47], [1024-1028]
Etodolac	10-20 (> 14[229])	40		6-8	[3], [8], [328]
Etomidate	0.1-0.5 (-1)			3.9 ± 1.1 (2-11)	[3], [9]
Etoposide	2-6 (peak 8-14)			4-11	[3], [11]
Etoricoxib	appr. 1.3-3.6			20-36	[47]
Etravirine (ETR)	0.275 (0.081-2.98)[302]			appr. 41	[2], [47], [110]
Everolimus	0.003-0.008 (-0.014)[275, 487]			28 ± 7	[329-332], [1029]
Ezetimibe	0.005-0.045	0.09[311]		appr. 30	[333, 334], [780]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Famciclovir	see Penciclovir				[47]
Famotidine	0.02-0.2	0.42[8]		2-4.5	[3], [335, 336]
Fampridine	see 4-Aminopyridine				
Favipiravir				4.6 ± 1.2	[1229]
Febuxostat	0.035-1.45			6-7	[780]
Felbamate	(30-) 50-110[164]	100[311]; 150-200		15-23	[4], [12], [337-339]
Felbinac	appr. 0.4-1[326]			10-17	[3], [340]
Felodipine	0.001-0.012	0.01		22-27[88]	[8], [84], [341]
Fenbufen	appr. -60			10-12	[3], [58]
Fendiline	0.02-0.15			appr. 20	[58]
Fenetylline (Fenethylline)[490]				appr. 1.3	[47]
Fenfluramine	0.04-0.3	0.5 – 0.7	6	18-25	[8], [58]
Fenitrothion			1.1-17[491]	33-64	[47]
Fenofibrate[489]	5-30[241]	60[311]		20-22	[3], [342], [780]
Fenoldopam	0.003-0.06			0.1	[8], [58]
Fenoprofen	(25-) 30-60	120[311]		2-3	[343], [780]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Fenoterol	(0.001-) 0.01-0.04			appr. 7	[929, 930]
Fentanyl	0.0003[4]-0.3[339]	-[339]	0.003-0.02[8,103]	1-3.5 (transdermal patch: appr. 17)	[47], [52], [54], [335], [344-351], [1071], [1078-1080]
Fenthion			1.4 (0.2-4.6)[279]	12	[47], [186]
Fesoterodine[492]	0.005[493]			5-9[494]	[47], [1030]
Fexofenadine	appr. 0.1-0.9[191]	2.7		14-18	[8], [352], [780]
Finasteride	0.008-0.01			5-7	[353]
Fingolimod	appr. 0.001-0.018[495]			6-9 days	[47]
Flecainide[48]	(0.2-) 0.4-0.8	1[311]; 1-2	2.6[8]; 13[8]; 15[8]	10-20	[70], [354], [780]
Flephedrone (4-Fluoromethcathinone, 4-FMC)			0.6[8]; 4.4[8]		[955]
Fleroxacin	appr. 5			(8-) 10-12 (-13)	[1031]
Flibanserin	appr. 0.4[496]			6-14	[1032]
Flocoumafen			0.005-0.273[497]	6-7 days[498]	[47]
Flubromazepam	-[421]	0.05-0.08; 0.412[8]	0.83[8, 401]	appr. 100	[835], [837-839]
Flubromazolam	appr. 0.008[421, 499]		0.059[8, 500]	10-20[501]	[836], [1031], [1033]
Flucloxacillin	3-30			1-2	[11], [58]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Fluconazole	appr. 2-6 (-15)	20; 95[8]		22-34[83]	[11], [91], [355-358], [1186]
Flucytosine	(20-) 25-50 (-70)	100		3-5	[8], [58]
Flumazenil[22]	(0.01-) 0.02-0.1	0.5		1-2	[931-934]
Flunarizine	0.025-0.2	0.3		days	[42]
Flunitrazepam[23]	0.005-0.015	0.05	0.3 (0.11-0.74)[502]	10-20 (-30)	[56], [59], [359], [1012], [1034]
Fluoride	0.095-0.190 (-0.285)[39]	0.5-2	3	2-9	[10], [47], [58], [130], [360-362]
5-Fluoro ADB (Methyl 2-[1-(5-fluoropentyl)-1H-indazole-3-carboxamide]-3,3-dimethylbutanoate = 5-Fluoro MDMB-PINACA)	-		0.11-1.92 ng/mL		[1035, 1036]
5F-AMB (5F-AMB-PINACA)	see AMB				
4-Fluoroamphetamine	-	0.06-0.43[503]	0.32[8, 504]		[47]
Fluorofentanyl	-		2.4 ng/mL[8]; 30 ng/mL		[1038], [1071, 1072]
2-Fluoromethamphetamine (2-FMA)	-		6.9 ng/mL[8, 506]		[1041]
4-Fluoromethlyphenidate	-	0.032[8, 417]			[840]
5-Fluorouracil	0.05-0.3	0.4-0.6		< 0.5	[3], [11], [58]
Fluoxetine	0.12-0.5[130]	1[311]	2.2; 3.8[507]; 6[8]	2-6 days[130]	[4], [47], [75], [202], [263, 264], [363, 364, [1084]]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Flupentixol (Flupenthixol)	0.0005-0.005	0.015[311]		20-40	[4]
Fluphenazine	0.001-0.01	0.015[311]		10-18[45]	[4]
Flupirtine	0.5-1.5	appr. 3-4	11[8]	7-11	[365], [1042]
Flurazepam[24]	0.075-0.165[508]	0.33[311]; 0.2-0.5	0.5-2.8[509]; 24[8]	appr. 2-3[24]	[4], [47]
Flurbiprofen	5-15			3-4	[366]
Fluspirilen	0.0001-0.0022	0.0044[311]		7-14 days	[4]
Flutamide[60]	0.4-1.5[60]			7-20[60]	[43], [367]
Fluvastatin	0.05-0.44		2.4[8]	1-3	[47], [1063]
Fluvoxamine	0.06-0.23	0.5[311]-0.65; 1.97[8]	2.8[8]; 5.4[8]	(8-) 15-22 (-28)	[4], [47], [202], [368, 369], [1084]
Folic acid	appr. 0.004-0.03[389]			1.5-2	[800], [944]
Fomepizole	8-35[510]			10-40 (dose-dependent)	[47], [1055-1058]
Formoterol	appr. 20-80 ng/L			5-13	[47]
Fosamprenavir (FPV)[513]	> 0.4[292]			4-11; 7.7[319]	[2], [47], [110, 111]
Fosinopril	appr. 0.13-0.25[511]; appr. 0.71-1.2[514]			6-17[512]	[47]
Fosphenytoin[336]	see also Phenytoin	30		0.13-0.25	[12]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
5F-Cumyl-PEGACLONE	see Cumyl				
5F-PB-22	-		0.37-1.5 ng/mL[505]		[1039, 1040], [1225]
Fospropofol[515]				0.7-0.9	[47]
Fremanezumab				30-32 days	[1102], [1104]
Frovatriptan	appr. 0.004-0.008			20-30	[47]
Furanyl fentanyl	-		2.7 (0.4-42.9) ng/mL[516]		[1011], [1071]
Furosemide (Frusemide)	2-5 (-10)	25-30		0.7-1.5 (-3)	[3], [47], [58]
Fusidic acid	30-200			4-6 (9-13)	[8], [1003]
Gabapentin	appr. 0.5-6 (-20-30)[185]	25[311]; 45[8]; 85[8]; 105[8]; 127[8]	37[8]	5-7 (-9)	[4], [12], [47, 48], [370-382], [804], [841, 842]
Galantamine (Galanthamine)	(0.01-) 0.03-0.06	0.09[311]		6-10	[4], [383, 384]
Galcanezumab	appr. 10-30 ?			27 days	[1102, 1103]
Gallopamil	0.02-0.1		8[8]	3-8	[84], [385]
Gamma-butyrolactone[517]	see 4-Hydroxybutyrate				[1043]
Gamma-hydroxybutyric acid (gamma-hydroxybutyrate, GHB, liquid ecstasy)	see 4-Hydroxybutyrate				[386, 387], [843-847], [1043]
Ganciclovir	(0.29-0.51) 0.5-5[107]	3-5		2-4[83]	[38, 39], [388]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Gemcitabine	3.9-5.3[146]	-[192]		0.05 (0.18-0.43)	[209]
Gemfibrozil	appr. -25			1.5	[3]
Gentamicin	(2-) 4-10[233]	12		1.5-6	[20], [67], [389-394]
GHB (gamma-hydroxybutyric acid)	see 4-Hydroxybutyrate				
Glibenclamide (Glyburide)	0.05-0.2	0.6		10	[47], [780]
Gliclazide	1-3.7			6-14	[47]
Glimepiride	0.09-0.5	1[311]		4-15	[47], [780]
Glipizide	0.1-1 (-1.5)	2		3-7	[66], [780]
Glutethimide	0.2-5	(5-) 10-30	15-50 (10-97[518])	5-20	[30], [47]
Glyburide	see Glibenclamide				
Glycerol	appr. 8 (2.9-17)[522]		3643[8]	0.6-1.1 (low concentrations); 2.5-10[523]	[47], [1044], [1074]
Glyceryl trinitrate (GTN)	see Nitroglycerin				
Glyphosate			3.7-1980[524]; 118-7480[525]	2-4	[47], [1059, 1060]
Gold	3-8[519]	(5-) 10-15	0.4[8]	21-31 days (oral)	[47, 48], [58], [1045]
Granisetron	appr. 0.005-0.017			3-21[520]	[3], [8], [47]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Griseofulvin	0.3-1.7			22 (9-33)	[8], [47]
Guaifenesin	0.3-1.4		25[8]	appr. 1	[3], [8], [47]
Guanethidine	0.01			5-10 days	[3], [58]
Guanfacine	appr. 0.001-0.01			13.5 (10-30)	[780]
Halazepam[15]	see Nordazepam			30-40	[13, 14]
Haloperidol	(0.001-) 0.005-0.017	0.006/0.023[521]; 0.015[311]; 0.05	0.18[8, 74]; 0.5	10-35[153]	[4], [43], [47], [185], [193], [240], [395-398]
Halothan	22-260		33-720[526]; 3.4/8.3[8, 527]	43	[48], [87]
Hematin	50-100				[13, 14]
Hemin	see Hematin				
Heptabarb (Heptabarbital)	0.5-4	8-15	20	6-11	[13, 14]
Heptaminol	appr. 0.2-1 (-1.5)			2-3	[13, 14]
Heroin (Diacetylmorphine, Diamorphine)[337]	-[338, 528]	-[339]		2-5 minutes	[273-281], [1046]
Hexachlorobenzene (HCB)	-0.0001[332]			appr. 2 years	[100]
ß-Hexachlorocyclohexane (ß-HCH, ß-Lindane)	-0.0001[332]			appr. 7 years	[100]
Hexachlorophene	0.003-0.65 (-1)		35	6-44	[11], [58]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
n-Hexane	< 0.09 ng/mL[463]			1.5-2	[47]
Hexapropymate	2-5	10-20			[8], [11]
Hexobarbital	1-5	10-20	50	4-6	[13, 14], [58]
Hirudin-rec	-[171]	-[171]		(1-) 2.5-3	[3], [43], [399]
Homosalate	0.004-0.023[583]			(18-) 47-78 (-162)	[1122]
Hydralazine[5]	0.05-0.5 (-1.5)			2-6	[84]
Hydrochlorothiazide	appr. 0.04-0.45 (-2)	4[311]		(6-) 9-12 (-15)	[3], [42], [779, 780], [1150, 1151]
Hydrocodone	0.01-0.04 (0.05)	0.1[311, 339]	0.13-7	appr. 4	[8], [47], [244], [780]
Hydromorphone	appr. 0.005-0.015 (-0.03)	0.1[311, 339]	0.03[8]; 0.06[8]; 0.2	2-3	[8, 9], [270], [400], [780], [1047], [1075]
4-Hydroxybutyrate (gamma-hydroxybutyric acid; GHB)[48]	appr. 50-120[393]	80 (abuse); 200[311]	30-9200 (mean 640; median 280; intoxication)	(0.3-) 0.5-1	[3, 4], [8], [47], [244], [401, 402], [843-847], [1043]
Hydroxychloroquine[384]	0.1-0.5[385]	0.5-0.8	4; 48[8]; 104[8]	dose-dependent days[386]	[3], [13, 14], [47], [403], [780], [848-852], [1226]
4-Hydroxy-3-methoxymethamphetamine (HMMA)	-[333]			11.5-13.5	[404-406]
Hydroxytryptophan (5-HTP)	appr. 0.5-1.5 (-9.4[529])			2-7[530]	[47]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Hydroxyzine	0.05-0.1	0.1	0.7[8]; 2.5[8]; 3[8]; 39[8]	7-20	[11], [47], [56], [58]
Hyoscyamine	0.0004-0.006			7.5	[780]
Ibandronat (Ibandronic acid)	< 0.1[321]			10-60; terminal: days	[47], [49], [1004, 1005]
Ibuprofen	15-30 (-50)	200	185[8]; 260[422]; 352[346]; 1233[531]	0.9-2.5 (-3)	[47], [293], [343], [407, 408], [926]
Idebenone	0.05-0.2[532]			(8-) 16-22 (-26)	[3], [47], [409], [1048]
Iloperidone	0.005-0.01	0.02[311]; 0.07[533]		18-33	[4], [1049]
Iloprost	appr. 0.0001			appr. 0.5	[936, 937]
Imatinib	0.72[258]			appr. 18	[410, 411]
Imipenem	0.5-5 (20-75)			1-1.5	[8], [412], [825], [833], [1186]
Imipramine[48, 125] plus Desipramine	0.05-0.35 0.175-0.3	0.5-1 0.3[311]	1.5-2	(6-) 11-25[26, 125]	[4], [74], [76-80], [308, 309], [413], [1084]
Inamrinone	-[534]		76[8]	4-6	[47]
Indapamide	0.13-0.25			14-15	[780]
Indinavir (IDV)	> 0.1[260]	appr. 0.5		1.5-2	[2, 3], [110, 111], [211], [414]
Indometacin (Indomethacin)	0.3-1 (-3)	4-5		5-10 (adults); 10-33 (neonates)	[47], [415], [780]
Indoramin	appr. 0.025-0.1			12 (3.5-15)	[95]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Infliximab	3-7[564]			6-12 days	[47], [1077]
25I-NBOMe	see NBOMe				
INH (isonicotinic acid hydrazide)	see Isoniazid				
Iproniazid	appr. -5 ?				[58]
Irbesartan	appr. 1.9-3.3[371]			11-15	[47]
Iridium	-0.02				
Iron	0.5-2	6	17	3-8	[42], [47], [58], [64]
Isavuconazole	appr. 2.5[535]			50-110	[47]
Isoflurane	appr. 20-150		1.8-48[537]	7 min to 58 h[536]	[47]
Isoniazid (INH)[5]	5-10	20	(30-) 100	(0.6-) 1-3 (-6.7)[5]	[3], [8], [317]
Isopropanol[361]		200-400	330[8]; 730[8]; 1000	2.5-3	[47], [58]
Isosorbide-dinitrate (ISDN)[538]	appr. 0.02-0.2[539]			0.4-0.8	[47]
Isosorbide-5-mononitrate (IS-5-MN)	0.1-1	3.1		2-5 (-8)	[47], [95]
Isotretinoin	appr. 0.001-0.002 (topical)[224]			10-20	[3], [416, 417]
Isoxicam	5-15			20-50	[8], [853]
Isradipine	0.0005-0.002 (-0.01)	0.01	0.26[8, 259]	5-10	[3], [84], [418-420]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
5-IT	see 5-(2-Aminopropyl)indole				
Itraconazole	appr. 0.4-2[111]			24-36	[421-424]
Ivabradine	appr. 0.01-0.06[620]	0.11[8]; 0.37[8]; 0.52[8]		1.3-2.8	[47]
Ivermectin	appr. 0.05[51]		0.09[8]	16-28	[3], [47], [425]
Kanamycin	trough: 1-4; peak: 10-25	25-30		(0.5-)2-3 (-5)	[8]
Kavain	appr. 0.05	0.18-5	1.4[8]	2.8-6.7	[47]
Ketamine	(0.1-) 1-6	0.02[540]; 0.42[562]; 7 (abuse)	3.8[8]; 6.9[8]	1-3 (-4)	[47], [56], [58], [426-428]
Ketanserin	0.05-0.5		2.8[8]	10-22	[8], [47]
Ketazolam[15]	0.001-0.02			1-3	[59]
Ketobemidone	0.01-0.05		0.2-3.2	1.8-4.2	[3], [47], [426], [428]
Ketoconazole	1-3 (-6)			6-10	[8]
Ketoprofen	1-6 (-20)	12[311]	1100[8]	1,1-2 (-4.2)	[47], [429-433], [780]
Ketorolac	0.5-3	5[311]		4-10	[3], [8], [780]
Ketotifen[541]	0.0004-0.004	0.02	1.2[8]?	(4-) 7-21 (-27)	[57], [1061, 1062], [1076]
Kratom	see Mitragynine				

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Labetalol	0.03-0.2 (-0.65)	1[8]; 2.9[8]	1.7[8]	3-10	[3], [7], [47], [95]
Lacidipine	0.001-0.006			12-19	[8], [1087]
Lacosamide	1-10	20[311]		10-15	[4]
Laetrile (Amygdalin)	see Cyanide				
Lamivudine	-[230]			5-7	[2, 3], [434]
Lamotrigine	1-15	20	36[8, 347]; 50[8]	(15-) 23-37[109]	[4], [8], [47], [435-437]
Lansoprazole	0.06-0.4			1-2	[780], [1088]
Lead	-0.09[324]	0.4-0.6	3	-[180]	[47], [64], [100], [438, 439]
Leflunomide[255]	6-100[256]			4-28 days	[3], [440-442]
Lenalidomide	0.06-1	2613 ng/h/mL[392]		3-4	[854-856], [1989, 1090]
Lercanidipine	appr. 0.1-10 ng/mL[620]	0.28[8]		6-10	[47], [1064]
Levacetylmethadol[50] (= Acetylmethadol)	appr. 0.02-0.06			32-116[50]	[8], [47]
Levamisole	appr. 0.1-0.7 (0.7-2.5)[569]			2-8	[8], [47], [1091, 1092]
Levetiracetam	(3-) 10-40	50[311]; 400[8, 264]		4-10	[4], [8], [443]
Levocabastine	< 0.001-0.01[147]			30-40	[444], [1093]
Levocetirizine[378]	0.3-0.5			6-10	[47]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Levodopa (L-Dopa)	0.3-2[28]	5[311]; 20[8]	650[8]	1-3[215]	[4], [445-449]
Levomepromazine[27]	0.005-0.025 (-0.2)	0.32[311]; 0.4	0.5	16-78	[4], [270], [1094]
Levomethadone[352]	0.04-0.4[339]	0.4[311]; 0.5[339]	0.04[8]; 0.1-0.2[362]	24-48 (-55)	[3, 4], [270], [450], [1095]
Levomilnacipran[570]	0.08-0.12[405]	0.2[311]		6-9 (-12)	[4], [780]
Levorphanol	0.007-0.02	0.1	0.9[8]; 2.7[8]	11-30	[8], [47], [1096]
Levothyroxine	0.045-0.14[47]			6-8 (-10) days	[451], [1097]
Lidocaine (Lignocaine)[571]	0.5-5[113]	6-7	10, 12[8]	1-4[113]	[47], [57], [70], [327], [452-454]
Linagliptin	0.002-0.004			50-90 (single dose); 110-150 (multiple dose)	[47], [780]
Lindane (ß-HCH, HCCH)	see Hexachlorocyclohexane				
Linezolid	0.5-4	appr. 7.5		4-6	[8], [823], [1098], [1186]
Lisinopril	(0.005-) 0.02-0.07	0.5[8]		4-12	[47], [84]
Lithium	4-8[79]	8[311]; 13	16	8-50[28]	[4], [47], [80], [264], [455-457]
Lofepramine[572]	0.003-0.01			0.5-5[572]	[47], [57], [458]
Loperamide	0.00024-0.0031[84]	0.12[8]	0.077[8]; 0.18[8]	7-15	[459], [857-860]
Lopinavir (LPV)	> 1.0[294]			5-6	[2], [110, 111]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Loprazolam	0.003-0.01			11-20	[59]
Loratadine[138]	0.001-0.02			2-15[138]	[460, 461]
Lorazepam	(0.02-) 0.03-0.25	0.3-0.5		10-16 (-40)	[4], [59], [224], [462, 463]
Lorcainide[573]	0.1-0.4 (-0.9)			5-10	[8], [464-466]
Lormetazepam[574]	0.002-0.01 (-0.025)	0.1[311]		8-15	[4], [59]
Lornoxicam	0.1-0.8			2-6	[8]
Losartan	< 0.2 (-0.65)[227]	1.8		1.5-2	[3], [8], [780]
Lovastatin[543]	0.003-0.018			2-3	[47], [1063]
Loxapine[23, 320]	0.005-0.03 (-0.1)	0.02[311]; 1	7.7	6-8[320]	[4], [8], [11], [58]
Lurasidone	0.015-0.04	0.12[311]		20-40	[4], [780]
Lysergide (lysergic acid diethyl amide, LSD)	0.0005-0.005	0.001	0.002-0.005	appr. 2-5	[8], [11], [58], [467]
Macitentan	0.2-0.4[620]			10-18	[47]
Magnesium	55-75[121]	120-140	150-180	2.1-2.9	[3], [47], [58], [468]
Malathione	-	0.35[8]; 0.5	1.8[8]; 175[8;] 517[8]	3-6	[47], [58]
Manganese	0.0005-0.0015		6.7[8, 575]	12-36 days	[47], [58]
Mannitol				0.25-1.2[83]	[3]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Maprotiline	0.075-0.13	0.22[311]; 0.5-1	1-5	20-60	[4], [8], [1084]
Maraviroc (MVC)	> 0.05[300]				[110]
MCPA	see 2-Methyl-4-chlorophenoxyacetic acid				
MCPP	see 2-Methyl-4-chlorophenoxypropionic acid				
MDA	see Methylenedioxy-amphetamine				
MDEA	see Methylenedioxyethyl-amphetamine				
MDMA	see Methylenedioxymethyl-amphetamine				
MDMB-PINACA	see 5-Fluoro ADB				
Mebendazole	≥ 0.1[67]			3-9	[47], [1099]
Meclizine (Meclozine)	0.001-0.045 (-0.15)			appr. 5-7	[47], [780], [861]
Meclofenamic acid (Meclofenamate)	appr. (1-) 2-7			0.8-5.3	[3], [780], [1214]
Mecoprop	see 2-Methyl-4-chlorophenoxy-propionic acid				
Medazepam[30]	0.1-0.5 (-1)	0.6		2-5[30]	[8], [47], [59], [61]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Mefenamic acid	2-10 (-20)	25		2-4	[9], [47]
Mefloquine	0.4-1[108]	1.5-2[8]		10-30 days	[47], [469, 470]
Melatonin	0.0005-0.1[379]			0.5-1	[47]
Melitracen	0.01-0.1			12-24	[8]
Meloxicam	0.4-2	4[311]		17-22	[8], [471]
Melperone	0.03-0.1	0.2[219, 311]	17[8]	4-8	[4], [8], [472, 473], [780]
Melphalan	-1.5			1.5-2	[8]
Memantine	0.09-0.15	0.3[311]	12[8]	60-100	[4], [47]
Meperidine	see Pethidine				
Mephenesin	3-10		16[8]	1-4	[8], [47]
Mepindolol	0.007-0.07			3-6	[7], [1100]
Mepivacaine	appr. 0.4-4[576]	5	50	1-3	[15], [58]
Meprobamate	5-10	10	30	6-17	[8], [56]
Meptazinol	0.025-0.25		16[8]	1-4	[8], [47], [1101]
Mercaptopurine[364]	0.03-0.1	1-2		0.5-1.5	[8], [47]
Mercury	appr. 0.0015-0.002 (< 0.005)[178]	0.05	0.5	> 18-24 days	[47], [64], [66], [100], [474-478]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Meropenem	> 2-8 (-12)[387]	25		1 (-7)	[862]
Mescaline	1.5-3.8			6	[47]
Mesalazine (Mesalamine)	appr. -1[119]			0.5-2.4[120]	[479]
Mesoridazine	0.1-1	3-5	3[8]; 4[8]; 16[8]	2-9 (-20)	[15], [47], [58]
Mesuximide	see Methsuximide				
Metaclazepam	0.05-0.2			7-23	[8], [59]
Metamizole (Dipyrone)[5]	10[32]	20[32]		5-8	[8]
Metandienone (Methandienone)			0.008[8, 424]		[940]
Metaxalone	0.6-3	11[8]	37[8]	2-14	[47], [780]
Metformin	0.1-2	5-10[397]	91[8]; 119[8]; 166[8]	2-9	[8], [58], [480, 481], [863-865], [938, 939]
Methadone	(0.05-) 0.1-0.6[135]	0.3[339]; 0.6[311]	0.4 (0.05-1)[362]	24-48 (-55)	[4], [482-489], [1095]
Methamphetamine (Methylamphetamine)	-0.1	0.2-1	1-18[8]; 40[8]	6-15[344]	[8], [47]
Methanol	appr. -3[577]	200	900	10-12 (-24)[325]	[8], [47], [58], [325], [490]
Methapyrilene	appr. 0.1	4	4.4[8, 408]; 12[8]; 380[8]		[11], [771], [867]
Methaqualone	1-3	3-5	5-10	10-40	[8]
Methemoglobin (Met-Hb)	-[199]	25-30%	50-70%		[3], [10, 11], [467]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Methimazole	0.5-2.5			2-28	[8], [467]
Methocarbamol	25-40 (-50)	250		1-2	[3], [11], [58]
Methohexital	0.5-5 (-11)[55]	2-20		1-6	[8, 9], [1107]
Methomyl	-	0.61[8]; 1.6[8]	1.6[8]; 26 (8-57)		[47]
Methotrexate (MTX)	0.01 – appr. 0.5[578]	0.75-1[579]	0.12[8]	(3-) 6-8 (low dose); 8-17 (high dose)	[3], [47], [1108]
Methotrimeprazine	see Levomepromazine				
Methoxsalen (8-Methoxypsoralene)	0.025-0.1 (-0.2)	0.6[8]; 1		0.5-1.5	[3], [10], [47], [58]
Methsuximide (Mesuximide)	10-40[223]	45[311]; 40-50		20-40 (-45)	[3, 4], [8], [11], [58], [491]
4'-Methyl-alpha-pyrrolidinohexanophenone (MPHP)	-		0.1[8]		[868]
2-Methyl-4-chlorophenoxyacetic acid (MCPA)	-	appr. 100	180[8]; 456[8]	12-72[187]	[3], [11], [47], [492]
2-Methyl-4-chlorophenoxypropionic acid (MCPP, Mecoprop)	-	appr. 100	669[8]; 715[8,181]	14-39[183]	[3], [11], [47]
Methyldopa	1-5	7[8]	9[8]	1.5-3 (4-14)	[9], [13, 14], [47]
3,4-Methylenedioxyamphetamine (MDA)[580]	-0.4	1.5	1.6-26[8]	(6-) 10.5-12.5 (-30)	[8], [47], [58], [404-406], [467], [493, 494]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
3,4-Methylenedioxyethylamphetamine (MDEA, MDE)	-0.2		1-4.2[8]; 12[8]	4-8[334]	[47], [493], [495-497]
3,4-Methylenedioxymethylamphetamine (MDMA, Ecstasy, XTC)	0.1-0.35[236]	0.35-0.5	0.4-0.8; 2.9[8]	(4-) 7-8 (-10)	[8], [58], [404-406], [467], [493, 494], [498, 499]
3-Methyl-fentanyl	-		0.3-1.9 ng /mL		[1071, 1072]
Methylphenidate	0.01-0.06	0.05[311]; 0.1-0.5; 0.107[8, 407]	2	2-7	[4], [8], [270], [866]
Methylphenobarbital (Mephobarbital)	see Phenobarbital				
4-Methylthioamphetamine (4-MTA, p-MTA)		1[8]	2[8]; 4.6[8]; 7.4[8]	7	[47], [500-504]
Methyprylon(e)[581]	1-20	12-25	50; 66[8]	3-11	[8, 9], [1109, 1110]
Metiamide	0.01-0.06				[58], [1111]
Metildigoxin (Methyldigoxin)[3]	see Digoxin				
Metipranolol[33]	0.02-0.08 (-0.17)			2-3.5	[15], [869]
Metoclopramide	(0.01-) 0.05-0.15	0.2	4.4[8]	3-6	[15], [66]
Metocurine	appr. 0.4-1			5-7	[1112]
Metolazone	0.005-0.05			6-11	[47], [780], [1113]
Metoprolol[48]	(0.02-) 0.035-0.5 (-0.6)	0.65[8]; 7.8; 12[8]	4.7[8]; 18[8]; 25[8]; 63[8]; 142[8]	2.5-7.5	[3], [7], [47], [870]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Metrifonate[582]	appr. 1.4-3.6			2-5	[8], [47]
Metronidazole	3-10 (-30)			6-14	[8], [1186]
Mexiletine	0.5-2	1.5-2	21-45[8]	6-17 (-26)	[47], [70], [505]
Mexoryl SX	see Ecamsule				
Mianserin	0.015-0.07	0.14[311]; 0.25-0.5	1.6[8]; 8.6[8]	14-33	[4], [8], [56], [223], [1084]
Mibefradil	appr. 0.2-0.3			17-25	[8]
Miconazole	< 1			24	[8]
Midazolam	0.04-0.1 (-0.25)[134]	1-1.5		1-3[46]	[8], [61], [224], [506-508]
Mifepristone (RU-486)	0.1-4[216]			(20-) 24-48 (-54)	[47], [509], [1114]
Milnacipran	(0.05-) 0.1-0.15	0.3[311]	22[8]	5-8	[4], [1115]
Milrinone	0.15-0.25	0.3		1-3	[3], [8], [42], [95]
Minaprine	appr. 0.1-0.4 (-1)?			appr. 25-34	[1119, 1120]
Minoxidil	appr. 0.02-0.2[149]	3.1[8]		1-4	[3], [84], [1116]
Mirabegron	0.005-0.03 (-0.1)			30-50	[780], [1117]
Mirtazapine	0.03-0.08 (-0.3)	0.16[311]; 1-2	2-3	20-40[188]	[3, 4], [510], [1084]
Misoprostol	-[286]			0.5-1	[3], [511, 512], [1118]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Mitotane	14-20	20		18-159 days	[513]
Mitragynine (Kratom)[467]	0.02-0.1[103, 585]	[339]	[413]; 0.23[8]; 0.6[8]; 1.06[8]	23 ± 16	[241], [871-877]
Mizolastine	appr. 0.2-0.8			5-17	[3], [8], [47]
Moclobemide[141]	0.3-1.0 (-3)	2[311]; (2.8; 18; 60.9)[586]	11[162]; 30	1-7	[514-519], [1084, 1085], [1127]
Modafinil	1-1.7 (-4)[257]	3.4[311]	35[8]	10-15	[4], [89], [520], [1126]
Moexiprilat[587]	0.005-0.04			2-10	[8]
Molindone	0.005-0.5	0.15[8]	6[8]; 9.3[8]	1.2-2.8	[47]
Molsidomine	0.002-0.03			1-2.5	[95]
Molybdenum	-0.005[588]	0.0077[8]			[47], [1129]
Montelukast (MK-0476)	0.02-0.3	0.6[311]		3-6	[3], [521], [1130]
Moricizine[23]	0.12-1.27			(3-) 6-13	[8], [467], [1131, 1132]
Morphine[288]	0.01-0.1	0.1[339]	0.1[339]	1-4	[87], [522-525]
Moxonidine	0.001-0.002 (-0.004)			2-4	[8], [95]
MT45	see 1-Cyclohexyl-4-(1,2-diphenylethyl)piperazine				
Muromonab-CD3 (OKT 3)	0.1-1.5			appr. 18	[1133, 1134]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Mycophenolate mofetil[212]	0.3-3.5[211]	44[8]		16-18[212]	[526-529], [1135]
Nabumetone	-[206]			-[206]	[47], [530], [780]
Nadolol	0.01-0.25		1.3[8]	(14-) 20-24	[7, 8], [47]
Naftidrofuryl (Nafronyl)	< 0.5		7.5[8]	1-2	[47], [1136]
Nalbuphine	0.02-0.2			2.5-7	[8]
Nalidixic acid	10-30	40-50		1-2 (-7)	[3], [8, 9]
Nalmefene	0.01-0.05	0.2[311]		5-11	[3, 4]
Naloxone	0.01-0.03			1-2	[8]
Naltrexone	0.003-0.05[99]	0.2[311, 589]		2-5 (-13)	[4]
Naphyrone (Naphthylpyrovalerone)		0.03[335]		appr. 34	[531]
Naproxen	(20-) 50-100	200; 414[8]	840[8]; 1040[8]; 1320[8, 599]	9-22	[8], [47], [293], [343], [532, 533], [1155]
Naratriptan	appr. 0.01-0.05			5-6	[3], [8]
Nateglinide	0.09-1.2 (-6)			1-2	[47], [780], [1136]
25I-NBOMe 2-(4-iodo-2, 5-dimethoxyphenyl)-N-(2-methoxybenzyl)ethanamine		0.3-2.8 ng/mL	0.24[8]; 0.76[8]; 4.7[8]; 16[8]		[47], [1050-1052]
Nebivolol[48]	0.001-0.02 (-0.06)[620]	0.12[311]; 0.48[8]		8-14 (-27)	[3], [8], [47], [534-536], [780]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Nedocromil	< 0.02			1.5-3.3	[3], [47]
Nefazodone	0.03-2.5[220]	5.5[8, 221]		2-6[222]	[3], [8], [537-542]
Nefopam	0.01-0.1	0.6[8]; 4[8]	12[8]	3-8	[8], [47]
Nelfinavir (NFV)	> 0.8[295]			3.5-5	[2], [87], [110, 111]
Neostigmine	appr. 0.001-0.01[127]			0.4-1.3	[316], [543]
Netilmicin	0.5-2; 6-10[590]	appr. 15-20		0.5-3[80]	[8], [878], [1137]
Nevirapine (NVP)	> 3.0[298]			25-30	[2], [110, 111]
Nicardipine	0.07-0.1		5[8]	7-12	[84], [1138]
Nickel	0.0015-0-005[330]	appr. 3[8]	7.5[8]; 19[8]		[47], [58], [100]
Nicotine	0.005-0.03[123]	0.4[8]	1-2[461, 462]	1-4[124]	[3], [8], [270], [544, 545], [1007-1010]
Nicotinic acid	4-18			0.3-1	[8]
Nifedipine	0.01-0.2		0.15[8]; 1.2[8]; 5.4[8]	2-5	[47], [84]
Niflumic acid	2-35			2-3	[8]
Nilvadipine	< 0.01			9-13	[84], [1139]
Nimesulide[235]	3-6.5			2-7 (11-20)	[3], [8], [546]
Nimodipine	0.01-0.05			1-2	[8], [84]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Nimustine (ACNU)	0.2-0.5 ng/mL				[58]
Nisoldipine	0.001-0.003	1.5[8]		7-12 (-15)	[3], [47], [84]
Nitrazepam	0.03-0.1	0.2[311]	5	18-30	[4], [8], [59]
Nitrendipine	(0.005-) 0.01-0.05			8-12	[8], [84]
p-Nitroaniline (4-Nitroaniline)	-		4.2[8]		[547]
Nitrofurantoin	0.5-5			0.7-1.5	[8], [1140]
Nitroglycerin (Glyceryl trinitrate, GTN)	appr. -0.015			20-30 minutes	[548]
Nitroprusside	see Thiocyanate	see also Cyanide			
Nizatidine	0.05-1			0.7-2.1	[8], [47]
Nomifensin(e)	0.01-0.1	8	17[8]	2-5	[8], [87]
Norclozapine (N-Desmethylclozapine)	see Clozapine			appr.8	[4]
Nordazepam (Desmethlydiazepam)[23]	(0.02[273]-) 0.12 -0.8	1.5[311]		30-90	[4], [8], [284, 285], [467]
Nordiazepam	see Nordazepam				
Norephedrine	see Phenylpropanolamine				
Norfenefrine	< 0.002 (-0.4)			(2-) 3-7	[8], [1141]
Norfloxacin	0.5-5			3-4 (-6)	[3], [47], [58]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Norfluoxetine (N-Desmethylfluoxetine)	see Fluoxetine			7-9 (4-16) days	[4], [1084]
Normesuximide (N-Desmethylmesuximide)[31]	10-40	45[311]		36-45	[4]
Norsertraline (Desmethylsertraline, DMS)	see Sertraline			appr. 70	[4], [879]
Nortriptyline[48] (see also Amitriptyline)	0.07-0.17 (0.05-0.15)	0.3[311]; 0.5	1-3	18-44 (-56)[68]	[4], [76], [80-82], [223], [1084]
Noscapine	0.02-0.4			1.5-4	[47]
Obidoxime	1-10 (appr. 10-20 µmol/L)			1-12	[58], [549], [1142]
Ocfentanil[395]	-		3.6[8]; 9.1[8, 396;] 15.3[8] ng/mL		[880-883], [1071]
Octisalate	0.001-0.006 (-0.017)[583]			27-77	[1122]
Octinoxate	0.001-0.008 (-0.03)[583]			50-157	[1122]
Octocrylene	0.001-0.02[419]			50-80	[801], [1122]
Ofloxacin	2-3 (-5.5)	39[8]		5-8	[3], [550], [1143]
OKT 3	see Muromonab-CD3				
Olanzapine[548]	(0.001-) 0.02-0.08[548]	0.1[311]; 0.12[8]	0.25[8]; 1[8]; 2.5[8]; 4.9[8]	(20-) 30-60	[4], [72], [101], [551-555]
Olmesartan	0.1-1			6-15	[47], [780]
Omecamtiv mecarbil	0.03-0.5	appr. > 1.2		18-21	[884-888]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Omeprazole[48]	0.05-4[98]	8[311]		0.5-1 (-1.5)	[780]
Ondansetron	0.03-0.3			3-5.5	[8], [66]
Opipramol	0.05-0.5	1[311]	3[8]-10	6-12[262]	[4], [8], [43], [556]
Orphenadrine	(0.05-) 0.1-0.2 (-0.8)	1.7	3.6[8]; 5	13-20	[9], [47], [56], [296], [557]
Oxaprozin	60-200			30-70	[47], [780]
Oxatomide	0.02-0.1	0.25	0.9[8]	14-30	[3], [47]
Oxazepam	0.2-1.5	2[311]	3.5; 4.4[8]; 5.3[8]	4-20	[3, 4], [56], [59], [283], [1231]
Oxazolam	see Nordazepam				[1145]
Oxcarbazepine	10-35[172]	35[8]; 40[311]-45		1-5[172]	[3, 4], [12], [47], [381], [558-560]
Oxpentifylline	see Pentoxyfylline				
Oxprenolol	0.05-0.3 (-1.0)	2-3	10	1-4	[7, 8]
Oxybenzone	0.083-0.532[419]			appr. 79[583]	[801], [1122]
Oxybutinin (Oxybutynin)[590]	0.001-0.02			2-5 (-12)	[8], [47], [780]
Oxycodone[48, 591]	0.005-0.1[339]	0.2[339]	0.6-0.7; 5[8]	2-5[53]	[47], [58], [244], [270], [1231]
Oxyfedrine	appr. 0.06			4.2	[95]
Oxymorphone[592]	0.5-5 ng/mL[339]	-[339]		(4-) 7-9 (-12)	[47], [780], [1146]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Oxyphenbutazone	25-100	200		48-72	[8], [47]
Oxypurinol[61]	5-15	20		18-30	[8], [11], [58]
Oxytocin	appr. -0.2 ng/mL			3-5 minutes	[3]
Paclitaxel	0.25-7[122]	-[593]		(4-) 8-20	[8], [47], [1147]
Paliperidone (9-Hydroxyrisperidone)[550]	0.02-0.06	0.12[311]		17-24 (-30)	[4], [47], [1194]
Pamidronate (Pamidronic acid)	< 0.02[323]			days[594]	[49], [561]
Pancuronium	0.025-0.1 (-0.6)[606]	0.4[8, 198]	0.7[8]; 1.6[8]	1.5-2.5	[8], [47], [562]
Pantoprazole	1.5-14[98]	28[311]		1-2	[3], [8], [47]
Papaverine	0.2-2			1-2 (6-7)	[47], [57], [780]
Paracetamol	(5-) 10-25	100-150[595]	200-300	2-4	[243], [563-571], [1148, 1149]
Paraldehyde	10-100	200	500	(3-) 4-10	[48], [87]
Paraoxon[596]	-	0.005			[11]
Paraquat	-	0.05	0.12[8, 348]; 1-2[201]	8-12[349]	[3], [11], [572-580]
Parathion[596]	-	0.01-0.05	0.05-0.08		[3], [10], [58]
Paroxetine[48]	0.002-0.065	0.12[311]; 0.4	1.2[8]; 3.7[8]; 4[8, 306]	16-24[93]	[4], [202], [263], [368], [581-583], [1084, 1085]
Pefloxacin	(0.1-) 1-10	25		8-15	[8, 9], [58]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Pemoline	1-7			7-13	[8]
Penbutolol	0.01-0.3 (-1.0)			17-26	[7-9]
Penfluridol	0.004-0.025			70	[3], [58]
(D-)Penicillamine	1.7-5.6 (-11)			1-3	[8]
Penicillin G	0.1-2.5 (-10)			0.5-1	[9], [780]
Pentachlorophenol (PCP)	-0.2	30	38[8]; 45	13-19 days	[11], [47]
Pentamidine	0.3-0.5	appr. 0.8		6-9	[3], [8]
Pentazocine	0.01-0.2	1-2[339]	3	2-5	[8]
Pentobarbital[598]	1-5	5	10	20-48	[8, 9], [47], [87]
Pentoxifylline[72]	appr. 0.5-2	4[311]	33[8]	0.5-3	[8], [47], [780]
Pentoxyverine	-0.18			2-3 (-6)	[8], [47]
Perampanel	0.18-0.98	1[311]		48-105	[4]
Perazine	(0.01-) 0.1-0.23	0.46[311]; 6.1[8]	9.6[8]	8-16 (-35)	[4], [8], [584], [1156]
Perhexiline	0.11-0.6[309]	0.6-1.2		(7-) 12-18 (-23)	[3], [585, 586]
Periciazine (Pericyazine)[597]	0.005-0.03	0.1		7-9	[9], [1154]
Perindopril[600]	0.08-0.15			0.8-3[265]	[3], [8]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Perphenazine	0.6-2.4 ng/mL[161]	5 ng/mL[311]		8-12 (-21)	[4], [587]
Pethidine (Meperidine)[115]	0.1-0.8[115]	1-2[339]	1 (-2)	3-6 (-10)	[588-592]
Phenacetin[62]	5-10 (-20)	50		appr. 1	[9], [13], [779]
Phenazepam	0.02-0.04[601]		1[8]; 1.6[8]	60	[47], [1157]
Phenazone (Antipyrine)	1-25	50		10-12 (-16)	[8, 9]
Phencyclidine (PCP)	0.01-0.2	0.007-0.24 (-0.8)	(0.3-) 1-5	1-12 (-50)	[8], [58], [467], [779]
Phendimetrazine	0.02-0.1		0.3[8]; 0.7[8]	2-4	[8], [47], [1158]
Phenelzine	0.001-0.002 (-0.2)	0.5	1.5[8]	6-8	[3], [58]
Pheneturide		5-20		30-90	[12]
Phenformin	0.03-0.1	0.6	3	4-13	[3], [8]
Pheniramine	0.01-0.27		appr. 2	16-19	[3], [8]
Phenmetrazine	0.02-0.25	0.5	4	appr. 8	[8]
Phenobarbital	10-40	40; 50[311]	50-60	60-130	[4], [8], [12], [161], [164], [415]
Phenol	< 10 (in urine)	50; 21.6[8]	50[8]; 90[8]	0.5-1 (-4.5); 14[8]	[11], [47], [889]
Phenprocoumon	1-3 (-5)[602]	5		100-160[35]	[11], [58]
Phensuximide	4-10 (-20)	80		4-12	[8], [58], [779]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Phentermine	0.03-0.1	0.9	1; 7.6[8]	appr. 20	[8], [47], [58]
Phenylbutazone[36]	50-100	120-200	400	30-175[37]	[9], [13]
Phenylephrine	0.4-3.4 ng/mL			0.5-4	[47], [168], [890-892]
Phenylpropanolamine (Norephedrine)	0.1-0.5	2	4.6[8]; 48[8]	3-7	[9], [47]
Phenytoin	(5-15) 10-20[81]	20-25[311]	38[8]; 43[8]	10-60[37]	[4], [161], [164], [593-600]
Pholcodine	0.02-0.08	0.1	1; 2.5[8]	35-75	[47], [1159]
Physostigmine	0.04-0.06			0.3-1.5	[303], [316], [601]
Pimozide	(0.003-) 0.015-0.02	0.02[311]		24-55 (-214)	[4], [47], [1160]
Pinazepam[15]	0.01-0.05			16	[59], [1161]
Pindolol	0.02-0.15	0.7-1.5		2-5	[7]
Pioglitazone	0.4-2			3-11 (-20)	[47], [780], [893], [1194]
Pipamperone	0.1-0.4	0.5[311]; 3.2[8]		17-22	[4], [47]
Piperacillin	1-5 (20-70)			1-2 (-4)	[8], [58], [1186]
Piperazine	0.02-0.1	0.5			[42], [58]
Pipotiazine	0.001-0.06	0.1		8-11	[3], [8, 9], [58]
Piracetam	appr. 20-50			4.5-7	[8]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Pirenzepine	0.03-0.45			8-20	[8]
Piretanide	appr. 0.1-1 (-4)[620]			0.6-1.7[83]	[47], [1203, 1204]
Piritramide	0.0035-0.014[128]	-[128, 339]	0.11[8]	4-10	[8], [47], [602]
Pirmenol	1-4			6-18	[3], [8], [11]
Piroxicam	2-6	14[8]		30-70	[8]
Pitavastatin	0.031-0.081			5-13	[47], [1063]
Pizotifen (Pizotyline)	0.007-0.009			26	[58]
Posaconazole	> 0.5-0.7[603]			20-66	[47], [603-605], [894, 895], [1162]
Practolol	1.5-5			5-13	[7-9]
Prajmalium (Prajmaline)[48]	0.06-0.44		3.9[8]	5-7	[8], [47]
Pramipexole	appr. 0.0002-0.007	0.015[311]		8-14	[4], [8], [467]
Pranlukast	appr. 0.2-1.2			appr. 2-9	[3], [8]
Pravastatin	0.0025-0.0063			appr. 3	[780]
Prazepam[15, 418]	see Nordazepam			1-3	[8], [47], [59], [896]
Praziquantel	appr. 0.2			1-2.5	[8], [1163]
Prazosin	0.001-0.02	0.9		2-3	[42], [47], [95]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Prednisolone	0.5-1	2[311]		2-6	[8], [780]
Prednisone	see Prednisolone				
Pregabalin	2-8 (-17)	10[311]; 13[8]; 60[8]; 67[8]	76[8]; 110[8]	appr. 6	[4], [373], [606, 607], [842], [897-899]
Prilocaine	0.5-1.5 (-2)[126]	5-6	appr. 20	1-2	[8], [327], [608]
Primaquine	appr. 0.1-0.2			4-7	[8]
Primidone[63]	5-10 (-15)	25[311]	65[8]	4-12 (-22)	[4], [8], [47], [161], [164]
Probenecid	20-200			3-17[37]	[8], [47]
Procaine	0.2-2.5 (-15)	20		-0.5	[15], [58]
Procainamide[5]	2.5-14	8-15	20	2-5 (-8)	[8], [70], [609]
Prochlorperazine	(0.001-) 0.01-0.05	0.2-0.3	5[8]	7-9 (-18)	[3], [9], [47], [58]
Procyclidine	0.08-1	1-2	7.8[8]	7-16	[8], [11]
Proguanil[48]	appr. 0.04-0.15[114]			13-24[114]	[58], [610]
Promazine	0.01-0.05 (-0.4)	1	5	5-41 (8 ± 7)	[8]
Promethazine	0.01-0.05 (-0.2)	0.1[311]; 1-2	2.4[8]; 1.8-5.4[250]	5-20	[4], [8], [56], [611, 612]
Propafenone[48]	(0.04-) 0.3-2	1.1[8]; 2	1.4[8]; 7.7[8]; 9[8]	2-10[48], 10-32[48]	[42], [47], [70], [613]
Propallylonal	0.3-10	appr. > 10		appr. 3	[8]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
2-Propanol	see Isopropanol				
Propantheline	0.002-0.05			1-4	[3], [47]
Propiomazine	0.05-0.2		0.1-5.4[8]	2-15	[47], [56], [614]
Propofol	1-8		2.4[8]; 2.5[8]; 4.3[8]; 5.3[8]	3-8[91]	[615, 616], [900-903]
Propoxyphene	see Dextropropoxyphene				
Propoxur	-		0.3[8]		[87]
Propranolol	0.02-0.3[403]	1	4-10	2-6	[7], [9], [42], [112], [1153]
Propylene glycol	0.05-0.5[403]	1000; 4700[8]		2-5	[47], [58], [617]
Propylhexedrine	0.01	0.5	1.7[8, 414]; 2-3	1 (nasal inhalation); 4 ± 1.5 (oral)	[58], [871], [904], [1164]
Propyphenazone	1.5-12.5			1-3	[8, 9], [1165, 1166]
Prothipendyl	0.03-0.08	0.05[311]; 0.5 (-1)	60[8]	2-3	[4], [8], [1167]
Protriptyline	0.05-0.3	0.5	1; 20.7[8]	50-200	[8], [58], [87]
Pseudoephedrine	(0.05-) 0.5-0.8	1.6[311]	19-20[280]	9-16	[11], [58], [266, 267], [269], [618, 619]
Psilocin[380]	appr. 0.008	0.018[8]		1.8-4.5	[47], [1168]
Psilocybin	see Psilocin				

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Pyrazinamide	30-75			(5-) 9-10 (-25)	[3], [9], [620]
Pyridostigmine	< 0.05-0.2			0.5-1.5 (-2.5)	[316], [621, 622]
Pyridoxine (Vitamin B_6)	0.003-0.018			3-6	[66], [800]
Pyrilamine			11[8]; 5-27[8]		[47], [87]
Pyrimethamine	0.1-2		1-10[8]	70-96	[3], [47], [1169]
Pyrithyldione	1-10			11-20	[9], [14]
Quazepam	0.01-0.05 (-0.15)[131]			39 (25-41)	[8], [11], [58, 59]
Quetiapine[549]	0.1-0.5[239, 600]	1[311]; 1.8	0.95[8]; 1.4[8]; 1.9[8]; 9[8]; 12.7[8]	appr. 5-7[240]	[4], [47], [87], [623-628], [807], [905], [1171], [1187]
Quinapril[617]	0.15-0.5[617, 620]			2-3[618]	[47]
Quinidine	2-5 (-8)	8-10	10-28[8]	4-12	[23], [70], [1170]
Quinine	1-7	10		4-15	[8], [58], [629, 630]
Rabeprazole	0.2-1.8	3.6[311]		1-2	[8], [780]
Raloxifene	0.67-1.3 ng/mL			15-45	[47], [780]
Raltegravir (RAL)	0.072 (0.029-0.118)[303]			7-12	[47], [110]
Ramipril	appr. 0.001-0.04[228]	0.08[311]		1-5	[3], [8], [780]
Ranitidine	0.05-1	3[311]		2-4	[8], [631], [780]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Ranolazine	0.37-1.1			3-15	[47], [780], [1172]
Rapamycin	see Sirolimus				
Reboxetine	0.06-0.35 [281]	0.7[311]		(8-) 12-14 (-30)	[3, 4], [632, 633]
Recainam	1.3-5.7			5-7	[634], [1173]
Remacemide	appr. 0.1-1			4	[8]
Remifentanil	-0.02			3-10 minutes	[8], [1071], [1174]
Remoxipride	2.15 ± 0.59[132]		41-150	5-10	[56], [635, 636]
Repaglinide	0.004-0.06 (-0.2)			0.5-2.5	[47], [780], [1175]
Reserpine	-0.0015-0.003			75 (2-12 days)	[47], [780], [1176]
Retigabine	0.45-0.9	1.8[311]		8-10	[4]
Retinol (Vitamin A)	0.2-0.8 (0.7-2.8 µmol/L)		1.2[8]		[66], [637], [800]
Ricin	0.003-0.01[601]	1.5[8]			[47], [638], [1177]
Rifabutin	0.05-0.15 (-1.1)			24-58	[3], [47], [1178]
Rifampicin (Rifampin)	0.1-10[101]	204[8]	55[8]	1-6[37]	[47], [317], [620], [639]
Rifapentine	4-24			10-15	[47], [620], [1179]
Rilmenidine	0.003-0.006[620]			6-10	[47]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Riluzole	0.05-0.5 (-1.5)			(5-) 9-15	[8], [47], [467]
Risedronat (Risedronic acid)	appr. 0.4-5 ng/mL			4-12 days	[47], [49], [998], [1180]
Risperidone[48, 550]	0.02-0.06[272]	0.12[311]	1.8[8]	2-4[159]	[4], [47], [457], [640, 641], [906, 907]
Ritonavir	appr. 5-11 (-20)			3-5	[2, 3], [642]
Rivaroxaban	(0.001-) 0.01-0.36	0.005-0.35		5-9; elderly 11-13	[794], [796, 797], [819], [908], [960], [1181]
Rivastigmine	0.008-0.02	0.04[311]		1-2 (oral); appr. 3 (transdermal patch)	[4], [8], [303], [643, 644]
Rizatriptan	0.015-0.1			2-3	[3], [8], [47]
Rocuronium	5-10 (-17)[606]		1.5[8]; 4.9[8]	appr. 1.5	[8], [47], [1182]
Roflumilast[158]	0.0013-0.0024			10-30	[47], [780], [1183]
Ropinirole	0.4-6 ng/mL	12 ng/mL[311]		2-10	[4], [8], [645]
Ropivacaine	0.4-1.8	(1-) 2[173]		2[168]	[47], [646-648]
Rosiglitazone[116]	0.1-0.3 (-0.65)			3-4	[8], [1184]
Rosuvastatin	0.006-0.02			12-32	[47], [780], [1063]
Rotigotine	0.1-0.7 ng/mL	2 ng/mL[311]		5-7	[4]
Roxatidine	0.1-0.8			5-6	[8]

Substance	Blood-plasma concentration (mg/L) therapeutic ("normal")	toxic (from)	comatose-fatal (from)	t½ (h)	References
Roxithromycin	4-12			6-15	[3], [47], [115]
RU-486	see Mifepristone				
Rufinamide	(2-) 5-30	40[311]		6-10	[4], [47]
Sacubitril[415]	appr. -3 (appr. -16 for Sacubitrilat)			3.9 ± 3.6[416]	[909]
Salbutamol (Albuterol)	0.004-0.014 (-0.02)	0.018-0.45	0.16	3-6	[58], [649], [1185]
Salicylamide	5-40			appr. 1	[8]
Salicylic acid[609]	20-200	300-400	(400-) 500	3-20	[3], [28], [30-33]
Salvinorin A	0.01-0.04[610]			40-80 minutes	[29], [47]
Saquinavir (SQV)	> 0.1-0.25[296]			(1-) 3-7 (-12)	[2], [47], [110, 111]
Saxagliptin[420]	0.008-0.025			2.5	[780], [910-912]
Scopolamine	0.1-0.3 (-1) ng/mL		1.2 ng/mL[8]	2-6	[8], [11], [47]
Secbutabarbital	5-10 (-15)	20	30	34-42	[8]
Secobarbital	1.5-5	7-10	10-15	15-30	[8], [87]
Selegiline	see Amphetamine and Methamphetamine				
Selenium	0.045-0.13 (-0.19)	0.4-1	2; (2.6[8]; 2.8[8]; 18.4[8]; 38[8])	69-77 days	[3], [47], [87], [650-652]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Seratrodast	3-25				[8], [1188]
Sertindole	0.05-0.1	0.2[311]		55-90	[4], [101]
Sertraline[423]	0.01-0.15 (-0.5)	0.29[8]; 0.3[311]	1.1-1.5; 1.6[8]; 3[8]	(22-) 24-28 (36)	[4], [58], [223], [653], [879], [1084, 1085]
Sevoflurane	40-80 (appr. -134)[381]		8[8]; 26[8]	1.8-3.8	[47]
Sibutramine[366]	appr. 0.001-0.01	0.11[8]		4-8	[8], [47]
Sildenafil	appr. 0.05-0.5	1[311]	6.2[8]	3-5	[8], [780], [1189]
Silver	-0.005[367] (-0.02[611])			48-52 days	[47], [58]
Simvastatin[544]	0.003-0.006	0.01[311]		2-4[290]	[48], [780], [1063]
Sirolimus (Rapamycin)	0.005-0.015[244]	0.015 (-0.06)		57-63	[654-657]
Sisomicin	0.5-10			appr. 1	[8], [1191]
Sitagliptin	0.05-0.38	0.72[311]; 3.8[8, 612]		8-14	[47], [780], [911], [1190]
Sodium aurothiomalate	see Gold				
Sodium nitroprusside	see Thiocyanate			0.1	[47]
Sodium oxybate (GHB)	see 4-Hydroxybutyrate				
Sodium valproate	see Valproic acid				
Sotalol[167]	0.5-3 (-4)	7.5-16[8]	36[8]; 40[8]; 43[8]	5-13 (-18)	[7, 8], [70], [658, 659]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Sparteine[48]	0.5-1			2.5	[8]
Spiramycin	0.4-3			5-8	[3], [660]
Spiraprilate	0.006-0.045			33-41	[8]
Spironolactone[545]	0.05-0.25 (-0.5)[73]			13-24[73]	[8], [47], [58], [1064]
Stanozolol			0.056[8, 424]; 0.257[8, 425]		[940], [943]
Stiripentol	1-10	15[311]		4-13	[3, 4], [8]
Streptomycin	1-5 (15-40)	40		2-4	[8], [11], [58], [467]
Strontium	-0.075			30-60	[47]
Strychnine		0.075-0.1	(0.2-) 1.6[8]-4.7[8]	10-15	[8], [11], [661-667]
STS-135				3 min (in vitro)	[1224, 1225]
Sufentanil	(0.02-) 0.5-10 ng/mL[6]	-[339]	1-7 ng/mL[8]; 27 ng/mL[8]	1.6-6.3 (7-49)	[47], [54], [344], [346], [668-671], [1071]
Sulbactam	8-80			1-2[70]	[3], [47], [174]
Sulfamethoxazole	30-60[56]	400		9-12	[8], [672]
Sulfasalazine[34]	5-30	50	130[8]	4-10	[8]
Sulfisoxazole	90-100 (-210)			5-8	[48], [1192]
Sulfinpyrazone	6-17			3-5	[8]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Sulindac	1-5[102]	10[311]	130[8]	appr. 7	[87], [673], [780]
Sulpiride	0.05-0.4 (-1)[225]	1[311]; 5[8]	3.8-39[8]	4-14	[4], [43], [47], [58]
Sultiam (Sulthiame)	0.5-12.5 (2-8)	12-15	20-25	3-30	[8], [491], [677]
Sumatriptan	0.018-0.06	0.12[311]		1-4	[8], [47], [780]
Suramin	> 100[117]	300[118]		44-54	[8], [58], [674]
2,4,5-T	see 2,4,5-Trichloro-phenoxyacetic acid				
Tacrine	appr. 0.01	0.02		2-4	[8], [303]
Tacrolimus	(0.0005-) 0.005-0.015 (-0.02)	(0.015-) 0.02-0.025; 0.123[8]		9-16	[11], [191], [675-684]
Tadalafil	0.09-0.48	0.96[311]		16-19	[47], [780]
Talinolol	0.04-0.15		5[8, 129]; 20[8]	10-14 (-20)	[7, 8], [47], [685, 686]
Talipexole	appr. 0.0001-0.001			5-9	[8]
Tamoxifen	0.05-0.5			5-7 days	[3], [47]
Tamsulosin	0.003-0.022			5-16	[47], [780]
Tapentadol	0.01-0.13 (-0.3)[339]	-[339]	0.3[8, 613]; 1.1[8, 614]; 2[8]; 6.6[8]	3-7	[47], [680], [684]
Taxol	see Paclitaxel				

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Teicoplanin	(10-) 15-20 (-40)	200		10-15; 83-168[83]	[8], [58], [688], [913]
Telmisartan	0.006-0.225 (-1.2)			(18-) 21-25 (-30)	[47], [780], [1151]
Temazepam	0.02-0.15 (-0.9)	1	3.8[8]; 8.2[8]; 9[8]	6-25	[8], [58, 59], [689], [702]
Tenoxicam[174]	1.5-4 (-10)			(50-) 70-90	[8], [47], [690, 691], [1193]
Terazosin	0.02-0.08	0.16[311]		8-12	[8], [780]
Terbinafine	0.01-0.03[205]			20-36	[3], [10], [47], [58]
Terbutaline	0.001-0.006 (-0.03)		0.04	16-20[89]	[8], [58], [1195]
Terfenadine[368]	< 0.01	0.04-0.06[148]	0.4[8]	15-22[64]	[3], [47], [692]
Tetrachloroethylene	-		4-5; 22[8]; 44[8]; 66[8]	33-72	[47], [58], [87]
Tetracycline	1-5 (5-10)	30		6-10	[3], [8], [11]
Tetrahydrocannabinol (THC)	see Dronabinol				
Tetrazepam[40]	0.05-0.6 (-1)			(10-) 16-44	[8], [47], [58, 59]
Thalidomide	0.5-1.5 (-8)			5-9	[3], [8]
Thallium	-0.002 (-0.0006[331])	(0.003-) 0.1-0.5[179]; 5.6[8]	0.5-11	2-4 days	[3], [11], [47], [100], [693, 694]
Theobromine	(4-) 10-15	20		6-10	[11], [58]
Theophylline	(5-) 8-15 (-20)[82]	20	50	6-9[41]	[415], [695-701], [703-705]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Thiamphenicol	0.5-3-10 (-15)	20		2-7	[8]
Thiamylal	appr. 5		29[8, 304]	0.6-0.8 (initial); 12-34 (terminal)	[47], [87]
Thiazinamium	0.05-0.15	0.3			[8], [11], [467], [1196]
Thiocyanate, from Nitroprusside	5-30[144]	35-100	200	3-4 days[83]	[8], [11], [255], [706], [1197, 1198]
Thiopental[57]	1-5	7	10-15[58]	3-8	[8], [48], [707], [1199]
Thioproperazine	appr. 0.001-0.02	0.1			[8, 9]
Thioridazine	0.1-0.2 (-2)[133]	0.4[311]	2.4[8]; 3-10	7-13 (-36)	[4], [8], [56]
Thiothixene	see Tiotixene				
Thyroxine	see Levothyroxine				
Tiagabine	0.02-0.2	0.3[311]; 0.5-0.6; 3.1[8, 245]		7-9	[3, 4], [8], [12], [381], [708-712]
Tianeptine	0.03-0.08	0.16[311]	5.1[8]	2.5-3	[4], [1200]
Tiapride	1-2	4		2-6	[8, 9], [47]
Tiaprofenic acid	appr. 15-40[193]			1.5-3 (-6)	[3], [713, 714]
Ticlopidine	< 1-2			70-130[100]	[47], [58]
Tiletamine			0.85[8]	1-4 (in animals)	[47], [87]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Tilidine[25]	0.05-0.3[339]	-[339]	1.7[8]	1-7	[9], [47], [715, 716]
Tiludronate (Tiludronic acid)	0.2-1.5 (-8)			65-78 (-150)	[49], [58], [717]
Timolol	0.005-0.05 (-0.1)			2-6	[8]
Tin	0.03-0.14				[58]
Tinidazol	10-50 (-60)			11-15 (-20)	[3], [47], [58]
Tiopronin	2-5			12-37	[58], [718], [1201]
Tiotixene (Thiothixene)	0.001-0.02 (0.01-0.1)	0.1		12-36	[47, 48], [58], [185]
Tiotropium	16 ng/L[307]			5-6 days	[719]
Tipranavir (TPV)	> 20.5[299]			5.5-6	[2], [110, 111]
Tizanidine	0.005 -0.045	0.09[311]		2-4	[3], [47], [780]
Tobramycin	< 2- (5-10)[154]	12-15		0.5-3	[3], [67], [198], [878]
Tocainide	4-12 (6-10)	13-15; 20[8]	74[8]; 78[8]; 140[8]	8-25	[3], [8], [47], [58], [720, 721]
Tofenacin(e)	0.025-0.1	0.5-1			[9], [58]
Tolbutamide	45-100	(120-) 400-500	640[8]	4-12	[8], [58], [722]
Tolcapone	3-6[615]	12[311]		2	[4]
Tolmetin	10-80	160[311]		2-4	[58], [780]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Tolperisone	0.09-0.3	0.7[8, 382]	7-14	1.8-2.9	[47]
Tolterodine[48, 492]	0.0008-0.002 (-0.005[493])			2-3	[47], [780], [804], [1030]
Toluene			10 (-48[8, 254])	13-68[254]	[47], [58]
Topiramate	2-10[218]	16[311]	49[8]	18-30	[4], [8], [381], [712], [1202]
Topotecan	appr. 0.001-0.01[190]			2-3	[3], [723, 724]
Torasemide (Torsemide)	0.064-0.52 (-2)			2-6	[47], [780], [1206-1208]
Tramadol[48, 584]	0.1-1 (> 0.3)[87, 339]	1[339]	2[8, 49]; 5.2[8]; 5.3[8, 404]; 9.4[8, 551]; 13[8]; 38.3[8, 252]	5-10	[11], [63], [244], [725, 726], [902], [1067, 1068], [1123-1125], [1231]
Trandolapril[619]	0.43-3 ng/mL[619, 620]		58 ng/mL[8]	0.6-0.8[619]	[47]
Tranexamic acid	10-50			1-3 (-10)	[8], [47]
Tranylcypromine	< 0.05	0.1[311]; 0.5[8, 202]	0.7[8]; 5[8]	1-3.5	[4], [727]
Trapidil	(4-) 6-10			2-6	[8], [95], [728]
Trazodone[145]	0.7-1 (-2)	1.2[311]; 3-4	9; 12-15[8]	4-11 (-13)	[4], [43], [58], [64], [263], [729]
Trenbolone			0.163[8, 425]		[943]
Triamterene	0.01-0.1 (-0.2)	0.2[311]		1.5-4 (-6)	[8], [42], [780]
Triazolam	0.002-0.02	0.04[311]	0.03[8]	(1-) 2-5	[4], [58], [423], [730, 731]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
2,2,2-Tribromoethanol		50	90		[58]
1,1,1-Trichloroethane			(15[8]); 100-1000	20-26[622]	[47], [58]
2,2,2-Trichloroethanol[369]	5-15	40-70	60-100	6-10[327]	[47], [58]
Trichloroethylene			9.7[8]; 16[8]; 21[8]	30-38[623]	[47], [87]
2,4,5-Trichlorophenoxyacetic acid (2,4,5-T)	-	appr. 100	200	11-23 (-33)	[3], [11], [47]
Trifluoperazine	0.001-0.01 (-0.05)	0.1-0.2	0.4[8]	7-18	[8], [87]
Triflupromazine	0.03-0.1	0.3-0.5		appr. 6	[8]
Trihexyphenidyl (Trihex)	0.05-0.2[75]	0.5	0.12[8]	(3-5) 24-41	[9], [47], [114], [1215]
Trimeprazine	see Alimemazine				
Trimethadione[274]	20-40			16	[58]
Trimethobenzamide	1-2		184[8]	7-9	[11], [47], [58]
Trimethoprim	1.5-2.5[56]	20		8-11	[8], [672]
Trimipramine[566]	(0.01-) 0.15-0.3	0.6[311]	1.7-8.2[251]	10-20 (-40)	[4], [56], [223], [1084, 1085]
Tripelenamine	0.02-0.06		10[8]	5-8	[8], [11], [57], [87]
Triprolidine	0.004-0.045			1-5	[47], [57]
Tropisetron[48]	(0.003-) 0.02-0.05 (-0.08)			7-9 (-30)	[8], [47], [66]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Tubocurarine	(0.04-) 0.4-3 (-6)			2-4	[8], [48], [58], [1216]
Tungsten	-0.035		5[8]	2-4	[47], [58]
U-47700[394]	-	0.24[8, 399]; 0.394[8]	0.017-0.49; 0.32[8]; 0.37[8, 400]; 0.53[8]; 0.82[8]; 1.1[8]; 1.52[8]; 3.04[8]	appr. 6	[837], [914-920], [1071]
Uranium	0.04 ng/mL[331]		0.77[8, 624]	450 days	[47], [100]
Urapidil	appr. 0.1-0.2			2-3 (-7)	[3], [58], [95]
Valdetamide	see Diethylpentenamide				
Valnoctamide	5-6 (-25)	40		7-14	[58], [1217]
Valproic acid	(40-) 50-100 (-150)	120[311]; 150-200	556[8]; 720[8]	7-17 (-20)	[4], [47], [64], [161], [164]
Valsartan	appr. 0.8-6	12[311]		5-12 (-14)	[8], [780], [909]
Vanadium	-0.05	0.0058[8]	6.2[8]	4-12 days	[47]
Vancomycin	10-20[142]	30 (-40)		3.6-11[83]	[47], [67], [390], [732-736], [823], [878]
Vardenafil	0.002-0.004 (-0.04)			2-5	[47], [780]
Varenicline	0.004-0.005	0.01[311]	0.26[8]	23-39	[4], [1218]
Vecuronium[624]	appr. 0.2-0.37 (-0.5)[624]		1.2[8]	1-1.5	[8, 9], [47], [1219]
Vedolizumab	> 14-16			appr. 25-26 days	[921]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Venlafaxine[567]	(0.06-) 0.1-0.4[189]	0.8[311]; 1-1.5[266]	3.2-24[8]	3-7 (-14)[625]	[4], [11], [101], [223], [737], [807], [1084, 1085]
Verapamil[90]	(0.01-) 0.02-0.25 (-0.4)	1	2.5; 0.9[8]; 3.9[8]; 85[8]	6-14[42]	[8], [42], [56], [64], [84], [721], [738, 739], [870], [922]
Vigabatrin	2-10 (-15)[94]	20[311]		5-8	[4], [47], [381]
Vilazodone	0.03-0.07	0.14[311]		18-32	[4]
Vildagliptin	0.18-0.3 (-1.6)			2-3	[911], [923, 924]
Viloxazine	1-4 (-8?)	47[8]; 60[8]	40[8]; 45[8]	2-5	[8], [43], [47]
Vincamine	< 0.25			1-2	[8], [47]
Vinylbital	1-3	5	8	18-33	[8]
Viquidil	0.15-0.25			6-12	[11]
Vitamin A	see Retinol				
Vitamin B_6	see Pyridoxine				
Vitamin B_{12}	(200-) 300-500 (-750) pg/mL[390]			21-29	[800], [944]
Vitamin C	see Ascorbic acid				
Vitamin D	(0.02-) 0.03-0.09[263]	0.2; 0.46[8]		appr. 30 days	[740-743], [800], [925]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Voriconazole	1-6	3.5 (-6.0)[284]		4-10[37]	[47], [603], [744, 745], [895], [1186]
Vortioxetine	0.006-0.04 (-0.07)	0.08[311]		57-66	[4], [780], [1194]
Warfarin	1-3 (-7)[602]	10-12	100	37-50[97]	[3], [14], [42], [746]
Wismut	see Bismut				
Xamoterol	appr. 0.02-0.05 (-0.2)			13-30	[58], [1210-1213], [1220]
Xipamide	3-11 (-20)			5-8	[47], [1209]
Xylene	< 0.002[616]		3-40	20-30	[47], [58]
Yohimbine[546]	appr. 0.05-0.3		5.2[8]; 5.4[8]; 7.4[8]; 8[8, 547]	1-3	[8], [47], [1065], [1221]
Zafirlukast	0.005-0.03 (0.7)			5-20	[8], [47]
Zalcitabine	appr. 0.1 (0.5 µmol/L)			1-3[83]	[38], [290]
Zaleplon(e)	(0.001-) 0.02-0.04 (-0.1)	0.2[311]		1-2	[4], [8], [935]
Zanoterone	0.1-0.5				[747]
Zidovudine	0.1-0.3 (-1)[51]	2-3; 24[8]		0.5-3	[2], [38], [47], [290], [748-750]
Zinc	0.6-1.3[626]	2	42[8]	5-16 months[627]	[47], [66], [1222]
Zipeprol	0.1-0.7		2.3-31[8]	1.2	[47], [57]
Ziprasidone	(0.02-) 0.05-0.2	0.4[311]		2-8	[4], [8]

Substance	Blood-plasma concentration (mg/L)			t½ (h)	References
	therapeutic ("normal")	toxic (from)	comatose-fatal (from)		
Zoledronat (Zoledronic acid)	0.22-2.2[628]			1-189 days	[47], [49], [751-753]
Zolmitriptan	0.003-0.01			1.6-3.8	[8], [47]
Zolpidem	0.08-0.16[629] (-0.2)	0.32[311]; 0.5	1.5-4	1-5	[4], [8], [11], [310], [754-756], [935], [1231]
Zomepirac	0.1-4		152[8]	4-10	[8], [87]
Zonisamide	(10-) 20-30 (-40)	40-70	100[208]	50-70[209]	[8], [47], [381], [712], [757, 758]
Zopiclone	(0.01-) 0.055-0.085[630] (-0.12)	0.15; 0.3[311]	0.6-1.8	2-8	[4], [11], [15], [56], [935]
Zotepine	0.01-0.15	0.3[311]		13-16	[4]
Zuclopenthixol[48, 365]	0.004-0.05 (-0.1)	0.1[311]		15-25	[4], [15], [1223]

Drug concentrations are mentioned as mg/L (= µg/mL), if not otherwise stated.

To convert drug concentrations to or from SI units, use the following formulas (MW = molecular weight):
To determine the conversion factor: $\mathrm{CF} = \frac{1000}{\mathrm{MW}}$

To convert *to* SI units: mg/L (= µg/mL) x CF = µmol/L
To convert *from* SI units: µmol/L ÷ CF = mg/L (= µg/mL)

Example carbamazepine (MW: 236.27): CF = $\frac{1000}{236.27}$ = 4.23

Conversion:
mg/L (µg/mL) → µmol/L: (8 mg/L) x 4.23 = 33.8 µmol/L

µmol/L → mg/L (µg/mL) : (33.8 µmol/L) ÷ 4.23 = 8 mg/L (= 8 µg/mL)

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, including ‘recreational’ use).

Toxic: blood-plasma/serum concentrations which produce toxicity/clinically relevant side effects/symptoms.

Comatose-fatal: blood-plasma/serum (comatose) concentrations and whole blood (fatal) concentrations reported to have caused coma and death, respectively. Whether published data for deaths refer to levels measured ante-mortem or post-mortem (femoral or heart blood) is often unknown.

In addition to specific references provided in the table, data were compared and contrasted against database sources, published review articles and textbooks [3, 4, 7-15, 41-43, 47, 48, 56-59, 64, 66, 74, 87, 88, 259, 270, 294, 467, 759-780, 878, among others] but not specifically indicated for every drug/substance, as well as supplemented with our experiences in clinical and forensic toxicology.

Meaning of brackets e.g., therapeutic plasma concentration = (0.02-) 0.08-0.25 or t½ = (4-) 8-22 (-35): These brackets may have slightly different meanings and depend on the substance. For example for antibiotics such as amoxicillin or ampicillin, they refer to trough and peak concentrations, respectively. In most cases, however, the concentrations in brackets refer either to (published) data mentioning a wider boundary of therapeutic (or toxic) concentration ranges but the majority of sources do not include this range or a concentration resulting from (very) low or (unusual) high doses.

This may also include different doses used in different indications (e.g., diuretics, betablockers, benzodiazepines, oral anticoagulants), acute vs. chronic application, very old or very young patients, patients with very low body weight/mass, or even slow and fast /extensive metabolizers. Sometimes (e.g., opioids), this reflect tolerability developed – that is, chronic opioid users may tolerate very high doses compared to opioid-naïve persons. Hence for opioid-naïve persons, a small dose (leading to a low blood/CNS concentration) might be deleterious.

As an example, for lorazepam [(0.02-) 0.08-0.25], the most cited and used therapeutic range is 0.08-0.25 mg/L. However, there is evidence that even lower concentrations may be measured after therapeutic low doses.

So, if not specifically mentioned or annotated, the data in brackets widen the range but do not cover most of the cases.

Annotations

1 active metabolites of acebutolol: N-acetylacebutolol ($t_{1/2}$: 9–14 h): therapeutic concentration 1–2.5 mg/L, comatose-fatal from appr. 90 mg/L, and diacetolol ($t_{1/2}$: 8–13 h): therapeutic 0.65–4.5 mg/L, comatose-fatal from appr. 100 mg/L

2 as salicylic acid (for analgesic and antipyretic effects)

3 as digoxin

4 typical therapeutic serum concentrations of fentanyl are 0.0003–0.0012 mg/L after application of a 25 mg/h transdermal patch; high concentrations during surgery and mechanical ventilation

5 slow (poor) and rapid (extensive) acetylators (metabolizers)

6 during mechanical ventilation

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 ($t_{1/2}$: 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 mg/L) 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 N-desmethyldiazepam = nordazepam (see Table)

16 nephrotoxic

17 active metabolite N-desmethylclobazam (therapeutic reference range: 0.3–3 mg/L; laboratory alert level[311] 5 mg/L)

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 benzodiazepine antagonist

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 mg/L[8]

26 in some cases up to 80 h

27 active metabolite levomepromazine sulfoxide ($t_{1/2}$: 5–10 h)

28 therapeutic concentration range 3-O-methyldopa 0.7–10.9 mg/L

29 active metabolite desipramine (see Table)

30 active metabolites diazepam, nordazepam, and temazepam (see Table) with longer $t_{1/2}$

31 active metabolite of mesuximide; the metabolite is the active compound in vivo

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 ($t_{1/2}$: 27–64 h)

37 dose dependent and depending on the duration of therapy; the drug stimulates its own metabolism

38 active metabolite of procainamide

39 for the management of osteoporosis

40 active metabolites diazepam (see Table), nordiazepam (see Table), and nortetrazepam ($t_{1/2}$: 25–51 h)

41 smokers: $t_{1/2}$: 3–6 h

42 for astemizole plus desmethylastemizole during steady state appr. 20 days

43 active metabolite dehydroaripiprazole

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 $t_{1/2}$ 8–22 h

47 physiologic, total serum (TT4; protein bound and non-protein bound); free T4 (fT4): 8–21 ng/L

48 rapid (extensive) and slow (poor) metabolizers (genetic polymorphism)

49 6 month-old-child, appr. 15 h after 100 mg tramadol rectally

50 active metabolites noracetylmethadol and dinoracetylmethadol

51 C_{max} 0.038 $\pm$ 0.006 mg/L after a single oral dose of 150 µg/kg in nine patients with onchocerciasis ($t_{1/2}$: 56 $\pm$ 7 h)

52 as enalaprilat

53 duration of clinical effect: 3–5 h

54 product after hydrolysis

55 narcotic; analyzed during the distribution phase

56 for pneumocystis carinii pneumonia (PcP) treatment: sulfamethoxazole 100–200 mg/L, trimethoprim 5–10 mg/L

57 metabolite: pentobarbital (see Table)

58 “narcotic”

59 higher with meningism (-25 mg/L); 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 (synonym acetaminophen, see Table)

63 active metabolites phenobarbital (see Table) and phenylethylmalonide (7-10 mg/L; $t_{1/2}$: 16–50 h)

64 as active carboxylic acid metabolite = fexofenadine

65 1 mg oral alprazolam/day equals appr. a plasma concentration of 0.01 mg alprazolam/L during steady state; usually, higher doses/plasma concentrations are recommended for the treatment of phobias when compared to panic disorders/attacks

66 highly inter- and intraindividual variable kinetics; for children (therapeutically): 0.04–0.1 mg/L; 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 x 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 ($t_{1/2}$ spironolactone: 1–4 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 proven

76 once or twice daily regimen: peak: 15–40 mg/L, trough: 1–5 (-7) mg/L; individually very variable

77 for hypertension: 0.2–0.45 mg/L; for coronary heart disease or arrhythmias: 0.3–0.8 mg/L

78 therapeutic concentration of the unbound fraction: 0.5–2 mg/L; therapeutic concentration of the metabolite desalkyldisopyramide < 5 mg/L (ratio of metabolite to the parent compound disopyramide guide to duration of therapy and possibly to the likelihood of toxicity)

79 in mmol/L (mEq/L, mval/L): 0.4–1.2 (0.6–1.4) mmol/L, toxic from 1.5 mmol/L; conversion factor: mmol/L x 6.93 = mg/L (mmol/L x 0.693 = mg/dL)

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 mg/L

82 for (sleep) apnea: 5–10 mg/L

83 increased in patients with impaired renal function

84 C_{max} 3–5 h after 4 mg loperamide hydrochloride orally: 1–3 ng/mL

85 active metabolite N-desmethylclomipramine ($t_{1/2}$: (21-) 37–43 (-65) h, mean: 40 h)

86 after a first dose in a group of patients given 1.5–2.5 mg/kg colistin methate, peak and trough serum colistin levels averaged 21 and 2.8 mg/L, respectively

87 post-operative (on-demand; i.v.): 0.02–1–2 mg/L (median: 0.29–0.92 mg/L) as minimal (analgesic) effective concentration; O-desmethyltramadol: 0.03–0.04 mg/L (median: 0.036 mg/L)

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 of the elimination: 0.5–1 h

92 as albendazole sulfoxide (active metabolite)

93 $t_{1/2}$ in slow (poor) metabolizers appr. 40 h

94 trough plasma concentration at steady state during 2 g twice daily orally appr. 9 mg/L; C_{max} (0.8 h after 1 g p.o.): appr. 45 mg/L

95 as active metabolite methimazole (thiamazole)

96 mean 80 min

97 15–85 h

98 plasma concentrations do not correspond with pharmacological effects

99 naltrexone plus 6-ß-naltrexone: 0.025–0.1 mg/L; plasma concentrations of the less potent major metabolite 6-ß-naltrexol ($t_{1/2}$: 11–13 h) are usually 1.5–10 times higher

100 at steady state; 4–15 h after a single dose

101 sum rifampicin plus metabolites

102 sum sulindac plus metabolites (sulindac sulfide, $t_{1/2}$: 15–18 h; $t_{1/2}$ sulindac 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 (non-active) carboxylic acid metabolite ($t_{1/2}$: appr. 20 days): 1.5–5.5 mg/L

109 during concomitant therapy with carbamazepine or phenytoin mean 13.5–15 (range 8–33) h, during concomitant therapy with valproic acid 48–59 (range 31–89) h

110 in infants and after intoxications in some cases dramatically increased to appr. 6–14 days

111 during steady state 3–4 h after oral doses of 100–400 mg; prophylaxis of candidiasis: > 0.2 mg/L and of aspergillosis: > 1.0 mg/L in patients with acute myeloid leukemia

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 mg/L

114 biologically active/major metabolite cycloguanil ($t_{1/2}$: 8–17 h): plasma concentration after daily oral doses of 100–200 mg proguanil appr. 0.02–0.06 mg/L

115 active metabolite norpethidine ($t_{1/2}$: 14–24 (-48) h) with higher toxicity than pethidine; toxic from appr. 0.5 mg/L

116 main metabolite N-desmethylrosiglitazone with appr. 20-fold lower potency

117 as cytostatic drug: > 200 mg/L

118 neurotoxic

119 in terminal renal insufficiency appr. 0.5–2 mg/L, cumulation of the inactive metabolite N-acetyl-5-aminosalicylic acid (Ac-5-ASA) up to 20 mg/L 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 (1.8–2.5 mg/dL, 0.74–1.03 mmol/L); conversion factor: mg/dL x 0.4113 = mmol/L

122 C_{max} appr. 2–8 µmol/L (i.e. 1.7–6.8 mg/L, after 135–390 mg/m^2 intravenously for 3 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 mg/L

127 for myasthenia gravis

128 half maximal effective concentration (EC_{50}) for analgesia: 0.0088 ± 0.0053 mg/L; EC_{50} for respiratory depression: 0.035 ± 0.022 mg/L

129 appr. 14 h after oral ingestion of 1.5 g and hemoperfusion

130 fluoxetine plus norfluoxetine; $t_{1/2}$ of the active metabolite N-desmethylfluoxetine (= norfluoxetine): 4–16, mean 7–9 days

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

133 range of plasma concentrations after therapeutically effective doses of thioridazine for the active metabolites mesoridazine (thioridazine-2 sulfoxide): 0.2–1.6 mg/L ($t_{1/2}$: 10–14 h) and sulforidazine (thioridazine-2 sulfone): up to 0.6 mg/L ($t_{1/2}$: 10–16 h) and for the inactive metabolite thioridazine-5(ring) sulfoxide: 0.06–4 mg/L; probably, the best correlation exists between the plasma concentration of mesoridazine and the clinical response

134 usually sleep occurred with ≥ 0.1 mg/L; in infants and children (< 13 years): in some cases during mechanical ventilation up to 3 mg/L; 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 (EDDP) during steady state: 0.005–0.055 mg/L (daily oral methadone dose: 10–225 mg, mean 60 mg)

136 ratio clozapine/active metabolite N-desmethylclozapine (= norclozapine, $t_{½}$: 19.2 ± 10.2 h) usually 1.0–2.5

137 maximum antiemetic effect at > 0.01 mg/L

138 active metabolite descarboethoxyloratadine (desloratadine, $t_{½}$: 17–24 h): appr. 0.005–0.02 mg/L

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) such as citalopram, clomipramine, fluoxetine, or paroxetine: possible serotonin syndrome

142 trough concentrations of 15–20 mg/L for complicated infections/sepsis as a surrogate (when the MIC is 1 mg/L or less) for the target 24-hour area under the concentration-time curve (AUC_{24}) to a minimum inhibitory concentration (MIC) ratio of ≥ 400; peak concentration: < 40 mg/L

143 distribution half-life: 0.3–0.5 (-1) h

144 non-smoker: 1–4 mg/L (17–69 µmol/L); smoker: 3–12 mg/L (52–206 µmol/L)

145 major active metabolite 1-m-chlorophenylpiperazine (mCPP); plasma concentration appr. 1/10 compared to trazodone

146 plasma concentration (15–20 µmol/L) for maximal cellular accumulation of the active form gemcitabine-5'-triphosphate

147 after nasal or oral application

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 mg/L and $t_{½}$ 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 of amoxapine and his major metabolite 8-hydroxyamoxapine ($t_{½}$: appr. 30 h; $t_{½}$ 7-hydroxyamoxapine: 4–6.5 h)

152 sum of bupropion (amfebutamone) and morpholinole metabolite ($t_{½}$: 19–22 h)

153 after i.m.-application as decanoate appr. 3 weeks

154 C_{min} < 1–2 mg/L at best (especially in patients with renal dysfunction)

155 appr. 0.02 mg/L in organophosphorous ester poisoning depending on 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 mg/L

158 active metabolite roflumilast N-oxide

159 extensive metabolizers; $t_{½}$ for poor metabolizers: 15-20 h; $t_{½}$ 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: 0.025–0.688 (median 0.098) nmol/L per mg oral perphenazine, and 0.096–0.750 (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 mg/L, i.e. toxic)

163 as R-enantiomer, mean: 9 mg/L

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 0.101 mg/L 4 h after ingestion of 70 mg and 0.185 mg/L at 10.5 h, complicated by oxazepam ingestion

167 data for d,l-sotalol

168 after i.v.-application; $t_{½}$: 4–7 h following epidural administration (appr. 4–5 h following intercostal block and appr. 6–8 h following brachial plexus blockade, respectively)

169 mean 19 h; $t_{1/2}$ of oral ciclosporine microemulsion is appr. 8 h

170 a longer $t_{1/2}$, up to 3.8 days, has been reported in elderly patients

171 target range of activated partial thromboplastin time (aPTT) is prolongation of 50–70 sec; aPTT prolongation of more than 100 seconds has been associated with an increased risk of hemorrhagic events

172 as 10-hydroxycarbazepine for seizures (0.4–2 mg/L for oxcarbazepine); in patients with trigeminal neuralgia, therapeutic target range of the active metabolite 10-hydroxycarbazepine ($t_{1/2}$: 7–14 (-20) h): 50–110 µmol/L (appr. 13–28 mg/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 mg/L; toxic from 0.3 mg/L, $t_{1/2}$: 11 h) and 3-methoxy-o-desmethylencainide (0.06–0.28 mg/L; $t_{1/2}$: > 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) mg/L; µmol/L x 0.026 = mg/L

178 reference value; 0.001 µg/g creatinine or 0.0014 mg/L urine; < 30 µg/24 h urine ("normal"); "toxic" from appr. 0.05–0.3 mg/L urine. Reference value for children in Germany: 0.0008 mg/L blood and 0.0004 mg/L urine

179 > 0.04 mg/L urine

180 up to (appr. 5–25) years in chronically exposed workers

181 combination with 2,4-D and chlorpyrifos

182 urine pH-dependent; in case of intoxication/overdose: 70–90 h

183 overdose

184 one case of toxicokinetic estimation in acute potassium cyanide (KCN) poisoning

185 dependent on indication; > 2.0 mg/L for partiell seizures; tentative target range according to Neels HM et al. 2004 [12]: 12–20 mg/L; peak concentration at steady state appr. 4.6 mg/L (300 mg three times daily (tid)) and appr. 8.4 mg/L (600 mg tid)

186 prolonged in case of impaired renal function to 16–43 h; > 100 h in dialysis dependent patients

187 dependent on urine pH, if alkaline appr. 8–10 h

188 females showed significantly longer elimination half-lives (35.4 ± 13.7 h) than males (21 ± 5 h); the $t_{½}$ of the R(-)-enantiomer is twice that of the S(+)-enantiomer

189 venlafaxine plus O-desmethylvenlafaxine. After doses of 25, 75, and 150 mg every 8 h for three days, mean peak serum levels were 0.053, 0.167, and 0.393 mg/L; corresponding levels of the major active metabolite O-desmethylvenlafaxine ($t_{½}$: 10–11 h) were 0.148, 0.397, and 0.686 mg/L

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 mg/L was observed in healthy volunteers after 60 mg (oral solution) every 12 h 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 three times daily

194 serum concentration of benzoic acid following high dose diazepam i.v.-infusion and severe metabolic acidosis (5-year-old girl; urine concentration: 1,200 mg/L)

195 1.5 h in dogs after i.v.-administration

196 for erythropoietic protoporphyria (EPP)

197 trough; peak: 0.1–0.5 mg/L

198 + 0.4 mg of its metabolite 3-deacetylpancuronium/L

199 "normal": ≤ 2–3% of total hemoglobin (Hb); from 15–20%: cyanosis, headache, dizziness

200 carboxyhemoglobin (COHb) averages 1–2% in urban non-smokers and 5–6% in smokers

201 2 h after ingestion; concentrations above 2 mg/L at 4 h, 1.6 mg/L at 12 h, 0.6 mg/L at 16 h, and 0.16 mg/L at 24 h are lethal

202 3 h after ingestion of 400 mg with no severe symptoms

203 mean steady state trough concentration; peak concentration: 5–15 mg/L

204 for Parkinson's disease (appr. 15–50 pmol/mL)

205 peak: 0.5–3 mg/L

206 plasma concentrations below detection limit; plasma concentrations of the active metabolite 6-methoxy-2-naphthylacetic acid (assumed therapeutic range 8.1–21 mg/L; $t_{½}$: appr. 23–24 h), which appears to be responsible for the effects, were 10–37 mg/L 3–6 h after single oral doses of 250, 500, and 1000 mg, respectively

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 (e.g., phenobarbital)

210 2–4 h in patients co-medicated with enzyme-inducing anticonvulsants (e.g., phenobarbital)

211 renal-transplant patients treated long-term (2–3 years) with mycophenolate mofetil had significantly lower trough plasma concentrations of the active metabolite mycophenolic acid (1.94 ± 0.24 mg/L) when compared to patients taking mycophenolate mofetil (1 g twice daily) short-term (2–10 months; 3.53 ± 0.45 mg/L); proposed mycophenolic acid pre-dose target concentration: 1–3.5 mg/L

212 as mycophenolic acid (active metabolite)

213 ten men with multiple sclerosis, 10–20 mg p.o. every 6 h and analyzed 30 min before the next dose; peak levels < 0.1 mg/L 30 min after a dose

214 nine patients, maximum tolerated oral dose 50–100 mg

215 $t_{½}$ of the metabolite 3-O-methyldopa: 15 h

216 appr. 2.5 µmol/l (1 mg/L) 24 h after single doses of 100–800 mg and during daily treatment with 200 mg

217 active metabolite 14-hydroxyclarithomycin ($t_{½}$: 5–7 h)

218 C_{max} following oral administration of 200, 400, 800, and 1200 mg, respectively: 3.7, 8, 18, and 29 mg/L; tentative target range according to Neels et al., 2004 [12]: 5–25 mg/L

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 ($t_{½}$: 2-5 h), m-chlorophenyl-piperazine ($t_{½}$: 4–10 h), and triazoledione ($t_{½}$: 10–12 h)

223 each as the active metabolite N-desmethylmesuximide; methsuximide ($t_{½}$: 1–2 h) steady state concentration: appr. 0.04–0.08 mg/L

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 mg/L ($t_{½}$: 29 ± 40 h), and for the 4-oxo metabolite ($t_{½}$: 22 ± 10 h): 0.16–0.68 mg/L

225 for depression; higher in case of schizophrenia (0.2–1 mg/L)

226 suggested threshold for the sum of clomipramine (0.05–0.06 mg/L) and N-desmethylclomipramine (0.16–0.18 mg/L): 0.2–0.24 mg/L

227 for the active metabolite E-3174 ($t_{½}$: 4–9 h); plasma concentration of losartan producing 50% of maximal blood pressure response to exogenous angiotensin-II: 0.032 mg/L

228 as ramiprilat ($t_{½}$: 13–17 (50–110) h)

229 half maximal inhibitory concentration (IC_{50}) 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 µg/L to 1.3 mg/L; C_{max} after 150–300 mg p.o.: 1.2–2.0 mg/L

231 C_{max} at steady state (666 mg three times daily p.o.)

232 after oral administration of the enteric-coated tablet

233 trough < 2 plus peak 6–10 (5–12) mg/L

234 reference value; < 0.015 mg/L urine

235 active metabolite 4'-hydroxynimesulide ($t_{½}$: 3–9 h)

236 mean C_{max} 126.5 and 226.3 ng/mL 2 h after 75 and 125 mg p.o. and 162.9 and 291.8 ng/mL after oral administration of 1.0 and 1.6 mg MDMA/kg body weight, respectively, to young adults; mean C_{max} for the metabolites 4-hydroxy-3-methoxymethamphetamine (HMMA) 171.9 and 173.5 ng/mL, 3,4-methylenedioxymethamphetamine (MDA) 8.4 and 13.8 ng/mL, and 4-hydroxy-3-methoxyamphetamine (HMA) 3.5 and 3.9 ng/mL, respectively

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 every 8 h appr. 0.8–1 mg/L

240 combination of distribution and elimination processes; $t_{½}$ up to 22 h in cases of overdose

241 as active metabolite fenofibric acid

242 appr. 37.5 mmol/L (= mval/L, mEq/L)

243 steady state concentration 21.6 ± 14.2 mg/L (mean ± SD) during continuous infusion of 3 g (1.1–2.2 mg/kg h) every 24 h in 44 patients undergoing coronary artery bypass graft surgery

244 target – whole blood – trough concentration if ciclosporine is being used at trough concentrations of 0.075–0.15 mg/L; without ciclosporine: appr. 0.03 mg/L (LC/UV assay)

245 4 h after ingestion of 30–40 tiagabine hydrochloride 8 mg tablets (coma)

246 bupropion plus 10-hydroxybupropion ($t_{½}$: 17–47 h)

247 calculated steady state concentration in children (4 months to 16 years) receiving 0.3 mg/kg body weight 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 µg/g femoral blood; in multiple-substance intoxication median 0.2 (P_{10}/P_{90}: 0.11/1.6) µg/g e.g., fatal overdose with tramadol, alprazolam (0.21 mg/L), and ethanol (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 whole blood

255 all data refer to the active metabolite teriflunomide (A771726)

256 steady state concentrations of 8.8 ± 2.9 mg/L at 5 mg/day, 18 ± 9.6 mg/L at 10 mg/day, and 63 ± 36 mg/L at 25 mg/day, respectively

257 steady state trough concentrations after 400 mg/d orally; two major metabolites modafinil acid (appr. 0.5–0.8 mg/L, $t_{½}$: 7.3 ± 1.1 h) and modafinil sulfone (appr. 4.5–5.3 mg/L), 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 chronic myeloid leukemia; peak: 2.3 mg/L

259 in a 5-year-old girl

260 suggested minimum target trough concentration in patients with HIV-1 susceptible to the antiretroviral drug (dose of 800 mg two times daily)

261 active metabolite N-desethylamiodarone ($t_{½}$: 57–64 days), which achieves plasma concentrations similar to the parent compound

262 inactive metabolites deshydroxyethylopipramol ($t_{½}$: 97 ± 24 h) and opipramol N-oxide ($t_{½}$: 10.7 ± 3.2 h)

263 as 25-hydroxyvitamin D [25(OH)D, calcidiol]; vitamin D deficient: < 0.01 mg/L (< 10 ng/mL = 25 nmol/L); vitamin D insufficient: < 0.02 (–0.03) mg/L (50 (–75) nmol/L); > 0.02 mg/L (> 50 nmol/L) considered optimal vitamin D status; conversion factor: mg/L x 2,500 = nmol/L (ng/mL x 2.5 = nmol/L)

264 6 h after reportedly ingestion of 30 g in a 38-year-old woman

265 metabolite perindoprilat, 3–10 hours, with a prolonged terminal half-life between 25 and 120 h

266 sum of venlafaxine and O-desmethylvenlafaxine

267 for glaucoma 4–5 mg/L

268 doxapram plus keto-doxapram

269 24 h after ingestion of appr. 20 mL

270 active metabolite desethylamodiaquine ($t_{½}$: 1–10 days)

271 smokers: –0.6 ng/mL

272 risperidone plus 9-hydroxyrisperidone; 0.002-0.02 for risperidone, 0.01–0.06 mg/L for 9-hydroxyrisperidone

273 as active metabolite after administration of therapeutic doses of diazepam

274 active metabolite dimethadione (see Table)

275 HPLC-MS/MS (or FPIA) blood, in combination with ciclosporine microemulsion

276 median (interquartile range, IQR) in n=439 patients at hospital admission (1.3 [0.4–3.5] µmol/L; in 35 deaths: median (IQR) 4.7 [3.6–5.9] µmol/L

277 median (interquartile range, IQR) in n=264 patients at hospital admission; in 61 deaths: median (IQR) 846 (657–1183) µmol/L

278 in the presence of ethanol or during ethanol treatment; t½ longer in patients with a serum creatinine concentration ≥ 130 µmol/L

279 median (interquartile range, IQR) in n=99 patients at hospital admission (4.9 [0.6–16.6] µmol/L; in 16 deaths: median (IQR) 12.3 [0.94–30.3] µmol/L)

280 3 dead infants aged ≤ 6 months with post-mortem blood levels of pseudoephedrine ranging from 4.7–7.1 mg/L

281 daily dose 2–8 mg p.o.

282 treatment goal: cystine levels < 1 nmol cystine/mg protein

283 according to other sources: < 0.005 mg/L; urine: < 0.012 mg/L; hair: < 0.5 µg/g; reference value for children in Germany: 0.015 mg/L urine. Case report: at day one 0.13–0.16 mg/L blood (urine: 67.5 mg/L) in a 43-year-old-male after ingestion of appr. 54 g arsenic trioxide

284 potentially increased risk for visual adverse effects (> 3.5 mg/L) and abnormal liver function, respectively

285 trough plasma buprenorphine and norbuprenorphine concentrations in excess of 0.0007 mg/L (0.7 ng/mL) were associated with minimal withdrawal symptoms in 11 heroin-dependent subjects

286 serum peak concentration of misoprostol acid (MPA) 574.8 ± 250.7, 287.6 ± 144.3, and 125.2 ± 53.8 pg/mL after sublingual, oral, and vaginal application, respectively, of 0.4 mg misoprostol to 40 women undergoing termination of pregnancy

287 on the first day of hospital admission after unintentional ingestion of appr. 400–500 mg carbachol (corresponding urine concentration: 374 mg/L).

288 main (probably inactive) metabolite: morphine-3-glucuronide (M3G); active metabolite: morphine-6-glucuronide (M6G)

289 metabolite: nordoxylamine

290 active ß-hydroxy-metabolite

291 targeted range between AUC of 9–12 mg/L/h

292 as amprenavir; suggested minimum target trough concentration in patients with HIV-1 susceptible to the antiretroviral drug (dose of 700 mg twice daily)

293 suggested minimum target trough concentration in patients with HIV-1 susceptible to the antiretroviral drug (dose of 300 mg once daily)

294 suggested minimum target trough concentration in patients with HIV-1 susceptible to the antiretroviral drug (dose of 400 mg twice daily)

295 suggested minimum target trough concentration in patients with HIV-1 susceptible to the antiretroviral drug (dose of 1,250 mg twice daily)

296 suggested minimum target trough concentration in patients with HIV-1 susceptible to the antiretroviral drug (dose of 1,000 mg twice daily)

297 suggested minimum target trough concentration in patients with HIV-1 susceptible to the antiretroviral drug (dose of 600 mg once daily)

298 suggested minimum target trough concentration in patients with HIV-1 susceptible to the antiretroviral drug (dose of 200 mg twice daily)

299 suggested minimum target trough concentration for antiretroviral therapy-experienced patients who have resistant HIV-1 strains (dose of 500 mg twice daily)

300 suggested minimum target trough concentration for antiretroviral therapy-experienced patients who have resistant HIV-1 strains

301 median (range) trough concentration from clinical trials (dose 600 mg twice daily); suggested threshold: > 0.55 mg/L

302 median (range) trough concentration from clinical trials

303 median (range) trough concentration from clinical trials

304 post-mortem heart blood level (death by hanging?)

305 active enantiomer of propoxyphene; active metabolite norpropoxyphene

306 heart blood

307 C_{max} at steady state achieved after 2–3 weeks of once-daily inhalation of 18 µg tiotropium; t_{max} after inhalation of 18 µg: 5 min

308 steady state peak concentration following a 300 mg twice daily or a 600 mg once-daily regimen

309 active metabolite cis-monohydroxyperhexiline ($t_{½}$: 10–29 h)

310 1–2 h after 50 mg

311 “laboratory alert level”; mostly according to AGNP Consensus Guidelines for therapeutic drug monitoring in psychiatry: update 2017 [4] i.e., drug concentrations above the recommended reference range, based on reports on intolerance or intoxications. In most cases, however, arbitrarily defined as plasma concentration that is 2-fold higher than the upper limit of the therapeutic reference range

312 active metabolite 6-hydroxybuspirone

313 C_{max} 1–2 h after 4 mg

314 at low dose therapy (2.5 mg); at maximum dose (25 mg): 0.001–0.004 mg/L

315 C_{max} 0.5–4 h after drug intake for 4 weeks

316 C_{max} after 2 h

317 60–90 min after intake of 1.2 mg/kg per day

318 four h after 20 mg

319 $t_{½}$ with ritonavir 15–23 h

320 active metabolite 8-hydroxyloxapine ($t_{½}$: 20–60 h)

321 C_{max} after 2h-infusion of 6 mg: 0.328 mg/L, after infusion of 2 mg: 0.246 mg/L

322 mean C_{max} after a single oral standard dose of 70 mg in healthy volunteers 33–41 ng/mL; mean C_{max} after a 2h-infusion of 10 mg: 265 ng/mL

323 mean C_{max} after a 4h-infusion of 15 mg: appr. 0.25 mg/L

324 male; female: –0.07 mg/L, children: –0.06 mg/L [reference value for children in Germany: 0.035 mg/L (whole) blood]

325 shorter in case of hemodialysis or continuous venovenous hemodiafiltration; in a, fatal, case with 4,400 mg methanol/L blood and in the presence of adequate ethanol level (1,000 mg/L or 1 ‰) appr. 3.5 h

326 after topical (dermal) application

327 prolonged in newborns (27.8 ± 21.3 h)

328 reference value for Germany: 0.014 mg/L urine

329 reference value for children in Germany: 0.0003 mg/L urine

330 reference value for children in Germany: 0.0045 mg/L urine

331 reference value in urine for children in Germany

332 reference value in whole blood in Germany

333 metabolite of 3,4 methylenedioxymeth(yl)amphetamine (MDMA)

334 t½ (R)-MDE: 7.9 (6–11) h; t½ (S)-MDE: 4.0 (3–6) h

335 40 h after oral ingestion of appr. 100 mg (0.03 mg/L 60 h after drug intake)

336 active metabolite phenytoin

337 prodrug; main active metabolites are morphine and morphine-6-glucuronide (M6G); main (probably) inactive metabolite = morphine-3-glucuronide (M3G)

338 in maintenance therapy e.g., for heavily dependent opioid addicts. 30 min after i.v- application of 150–300 mg diacetylmorphine (heroin): 0.1–0.24 mg/L morphine (t½: 1–4 h), 2.6–5.9 mg/L morphine-3-glucuronide (M3G; t½: (2–) 3–5 h), 0.5–1.0 mg/L morphine-6-glucuronide (M6G; t½: (1–) 2–3 h), and 0.08–0.29 mg/L 6-monoacetylmorphine (6-MAM; t½: appr. 2–5 min; n=4); in another study 30 min after i.v- application of 260–300 mg diacetylmorphine: 0.39–0.75 mg/L morphine, 3.2–5.2 mg/L M3G, 0.5–0.7 mg/L M6G, and 0.08–0.19 mg/L 6-MAM (n=4)

339 depending on tolerance and state/severity of pain

340 metabolites: norbuprenophine (active; plasma concentration after therapeutic buprenorphine doses appr. 0.5–2 (-20) ng/mL; t½: 35.6 (1.1–66.8) h after i.v., 73.6 (13.4–143) h after buccal, and 83 (10–243) h after sublingual application), buprenorphine-glucuronide, and norbuprenorphine-glucuronide

341 active enantiomer of zopiclone

342 active enantiomer of methylphenidate

343 active enantiomer of citalopram

344 strongly dependent on pH of urine

345 symptomatic poisoning in adults is more likely with doses above 90 mg

346 on hospital day #2

347 19 h post-ingestion of appr. 4 g

348 five h post-ingestion; all patients with a plasma paraquat level above 3.44 mg/L died

349 prolonged in (paraquat-induced) renal failure to appr. 80–120 (-150) h

350 active enantiomer of moramide

351 active enantiomer of fenfluramine

352 active enantiomer of methadone (see Table); in many cases, analytical discrimination between both enantiomers is not possible

353 after a bolus dose of 0.25 mg/kg body weight (n=10): 2.3 mg/L at 3 min, 0.84 mg/L at 30 min, 0.61 mg/L at 1 h, and 0.44 mg/L at 2 h

354 active metabolite oxypurinol

355 eleven h post-ingestion

356 $t_{½}$ in poor metabolizers of cytochrome P450 2D6 is appr. 21 h

357 metabolite of cocaine

358 dependent on pH of urine

359 sum of dibenzepine and desmethyldibenzepine

360 active metabolite of trimethadione

361 metabolite: acetone

362 in non-users of opioids

363 active metabolite norlorcainide ($t_{½}$: 28–32 h), therapeutic plasma concentration: 0.1–1.5 mg/L

364 metabolite of azathioprine

365 (cis-)isomer of clopenthixol

366 active metabolites norsibutramine ($t_{½}$: 12–22 h) and dinorsibutramine ($t_{½}$: 14–23 h)

367 with silver sulphadiazine ointment for burns: 0.06–0.6 mg/L (non-toxic)

368 active metabolite fexofenadine

369 as metabolite of chloralhydrate

370 peak plasma concentrations (C_{max}) in four subjects after 1 h chewing khat leaves that supplied 28.1–45.1 mg cathine and 34.3–64.1 mg cathinone

371 higher for poor metabolizers of cytochrome P450 2C9

372 enantiomer of loratadine

373 0.001–0.0035 mg/L for the active metabolite 3-hydroxydesloratadine (t½: 17–27 h)

374 enantiomer of ketoprofen

375 after a single oral dose of 2 mg

376 average of 12 victims

377 serum morphine (active metabolite) levels were appr. 0.013 in extensive metabolizers and 0.003 in poor metabolizers

378 enantiomer of cetirizine

379 endogenous: –0.01–0.09 ng/mL

380 active metabolite of psilocybin

381 during anaesthesia

382 measured 14 h post-ingestion

383 serum concentrations from 1.2–2.0 ng/mL (0.0012–0.002 mg/L) were associated with a higher risk of death

384 main metabolite desethylchloroquine

385 plasma concentrations of hydroxychloroquine less than 0.2 mg/L are indicative of poor medication adherence in patients with systemic lupus erythematodes. Mean serum concentration in n=20 patients treated with oral doses of three times 200 mg hydroxychloroquine sulfate daily for COVID-19 was 0.46 ± 0.2 mg/L [1226]

386 at least 5 days; terminal t½ appr. 43 days

387 for actual minimal inhibitory concentration (MIC) distributions see e.g., EUCAST database at: www.eucast.org

388 urine: < 0.0006 mg/L, < 0.0007 mg total Cr/24 h

389 appr. 9.1–68.1 nmol/L

390 to convert pg/mL to pmol/L, multiply by 0.7378. In a recent general population study in the Netherlands, plasma concentrations > 455 pg/mL were associated with increased risk of all-cause mortality

391 sum enzalutamide and active metabolite N-desmethylenzalutamide; at week 13 in metastatic castration-resistant prostate cancer (mCRPC) patients taking 160 mg enzalutamide/d (n=680), the trough concentration for enzalutamide was 11.4 ± 2.95 mg/L, 13.0 ± 3.8 mg/L for N-desmethylenzalutamide, and 8.4 ± 6.8 mg/L for the carboxylic acid metabolite

392 cutoff $AUC_{0\text{-}24}$; can be a good predictor of grade 3-4 adverse events in elderly (Japanese) patients with newly diagnosed multiple myeloma

393 suggested cut-off for endogenous concentrations: blood 4 mg/L, urine 10 mg/L, and hair 3 ng/mg

394 N-desmethyl-U-47700 is probably a better blood and (mainly) urine biomarker of U-47700 intake and intoxication. N,N-didesmethyl-U-47700 is another biomarker

395 O-desmethylocfentanil is probably a relevant metabolite

396 post-mortem in peripheral blood; in heart blood: 0.005, 0.023, and 0.027 mg/L

397 to minimize the development of lactic acidosis plasma concentrations above 2.5 mg/L should be avoided

398 C_{max} during steady state; $t_{½}$ of N-debutyl-dronedarone appr. 20–25 h

399 + 1.4 mg/L phenazepam

400 + 0.83 mg/L flubromazepam ($t_{½}$ appr. 100 h)

401 + 0.37 mg/L U-47700

402 trough edoxaban concentration related to frequency of major gastrointestinal bleeding (MGIB); probability of MGIB significantly increased at appr. 0.06 (-0.1) mg/L

403 after dermal or inhalative occupational exposure

404 + 0.2 mg/L propofol; self-administration

405 steady state concentrations expected under a therapeutic dose of 100 mg/d

406 0.2–2 h after 4 mg

407 in a 14-year-old girl 2.5 h after ingestion of 21 long-acting methylphenidate 54 mg tablets (total of 1,134 mg methylphenidate)

408 + 900 mg/L ethanol

409 $t_{½}$ in 3–12 months-old children appr. 2.5 h

410 high level of protein binding

411 active (?) metabolite cyclopropylnorfentanyl

412 in 32 cases, post-mortem serum concentrations of 0.0153 ± 0.0119 mg/L (median 0.0123 mg/L) cyclopropylfentanyl were reported

413 post-mortem blood concentrations ranging from 0.02 to 0.18 µg/g in nine cases of accidental intoxications where mitragynine and O-desmethyltramadol were detected

414 fatal case, together with a blood concentration of 0.39 mg/L mitragynine; the cause of death was ruled propylhexedrine toxicity

415 on the market as sodium salt complex of anionic forms of sacubitril (an inactive prodrug of the active neprilysin inhibitor, sacubitrilat [$t_{½}$: 18.4 ± 6.8 h[416]]) and valsartan

416 in patients with heart failure with reduced ejection fraction; $t_{½}$ is higher when compared to healthy subjects, $t_{½}$: sacubitril 1–2 h, sacubitrilat 9–13 h

417 as (±)-threo 4-fluroromethylphenidate (4F-MPH); urine concentration 0.83 mg/L

418 as (the active metabolite) desmethyldiazepam = nordazepam

419 maximum plasma concentration after applying 2 mg of sunscreen (spray, lotion or cream) per 1 cm^2 to 75% of body surface area (BSA) 4 times per day for 4 days (each n=6 healthy volunteers)

420 active metabolite 5-hydroxysaxagliptin ($t_{½}$: 3–7 h)

421 according to Høiseth et al. [835], the median (range) concentrations in 'drugged drivers' were:
0.012 mg/L (0.00048-0.10) for flubromazolam (n=25),
0.055 mg/L (0.0047-1.2) for flubromazepam (n=24),
0.013 mg/L (0.0021-0.057) for diclazepam (n=15),
0.050 mg/L (0.019-0.17) for etizolam (n=14),
0.0053 mg/L (0.0019-0.011) for clonazolam (n=7) and
0.074 mg/L for pyrazolam (n=1).

422 + 560 mg/L valproate

423 active metabolite norsertraline (desmethylsertraline, DMS)

424 post-mortem femoral blood concentrations of appr. 0.001 mg/L clenbuterol, appr. 0.056 mg/L stanozolol, and appr. 0.008 mg/L metandienone in a 34-year-old male bodybuilder with previous unknown heart disease

425 post-mortem blood concentrations of 0.163 mg/L trenbolone and 0.257 mg/L stanozolol in a 36-year-old male bodybuilder

426 one hour after the last oral 300 mg dose

427 active metabolite 4-hydroxyalprenolol, therapeutic: 0.04–0.06 mg/L

428 0.6–0.7 hours after oral ingestion of 50, 100, or 200 mg average plasma concentrations of 0.68, 0.88, or 2.15 mg/L were achieved

429 prodrug of azilsartan

430 patients receiving a single daily oral 5 mg-dose for two weeks developed steady state peak plasma concentrations averaging 0.05 mg/L at 2.3 h post-administration

431 a single dermal scalp application of 5% benzyl alcohol lotion resulted in plasma benzyl alcohol concentrations of 1.6–3.0 mg/L at 0.5–1 hours in four of 19 children ages 6 months to 11 years

432 two h post-ingestion

433 same case, 20 h post-ingestion (prior to death), in a mixed intoxication with MCPA

434 a single oral 300 mg-dose in 4 healthy adults led to an average peak plasma carboxybuprenolol concentration of 4.19 mg/L

435 buproprion + hydroxybupropion

436 t½ buproprion: 1–15 h, t½ hydroxybuproprion: 17–47 h

437 buspirone + 8-hydroxybuspirone 0.001–0.004 mg/L

438 t½ for metabolites

439 active metabolites are N-desmethylcariprazine and N,N-didesmethylcariprazine

440 active metabolite meprobamate, therapeutic plasma concentration: 10–30 mg/L, t½ : appr. 8 h

441 carisoprodol concentration (without meprobamate); corresponding meprobamate levels were 6.8–62 mg/L

442 car drivers with no signs of impairment

443 during anaesthesia

444 plus 86 mg/L desmethylclobazam

445 the active metabolite of clopidogrel is a thiol derivative which is mainly formed via cytochromes P450 (CYP2C19, among others) in the liver

446 at 4–8 h

447 ‘Holland film’; 15 hours post-ingestion

448 ante-mortem; post-mortem femoral vein blood 0.6 ng/g, urine 2.93 ng/g

449 current German biologic tolerance value (BAT) for exposure to cresol isomers in the workplace is 200 mg/L in an end-of-shift urine specimen

450 in exposed workers at air concentrations of 5–710 ppm at the end of the day

451 mono intoxications

452 after oral administration in mice

453 several days after exposure

454 17-month-old child

455 post-mortem blood concentrations

456 simultaneous use of alcohol and disulfiram

457 0.2–0.35 mg/L at 2 h, 0.05–0.16 mg/L at 12 h

458 in poor metabolizers

459 diazepam plus nordazepam (see Table)

460 peak plasma concentration of an oral standard dose of 800 mg clodronate

461 a lethal blood concentration of nicotine is about 2 mg/L, corresponding to appr. 4 mg/L plasma

462 cotinine concentration in urine in a 15-month-old female 12 h after admission to ICU was 1.7 mg/L; she died at hospital day 44

463 median blood hexane level of 1,200 unexposed United States citizens

464 data from 13 fatalities, post-mortem femoral blood

465 mg/kg; 11 persons with certified deaths by intoxication with more than one drug and/or with drugs in combination with a significant concentration of ethanol

466 prodrug of 4-hydroxybutyrate (GHB)

467 active metabolite 7-hydroxymitragynine with appr. 30 times higher potency at μ-opioid receptors

468 a peak plasma concentration of 0.0034 mg/L diclazepam was achieved after oral intake of 1 mg diclazepam

469 peak plasma concentration after 1 μg/kg intranasal dexmedetomidine 0.00025–0.00028 mg/L (0.25–0.28 ng/mL). Peak plasma concentration of 0.00034 mg/L (0.34 ng/mL) 38 min after an intranasal dose of 84 μg to 6

healthy men; the same dose given by 10 min intravenous infusion to the same subjects produced median end of infusion peak plasma level of 0.0035 mg/L (3.5 ng/mL)

470 three fatal cases with more than one drug and/or with drugs in combination with a significant concentration of ethanol

471 four cases

472 blood concentrations of emetine were measurable in only 6 of 10 emergency room adult patients who received 30 mL of ipecac syrup for treatment of drug or chemical overdose

473 arterial blood enflurane levels present in 4 adult surgical patients during enflurane anaesthesia

474 fatalities after enflurane abuse

475 appr. 3 mg/L 6 h after the last dose in 20 patients who received 400 mg twice a day over a period of 4 days

476 peak plasma levels 1–2 hours after ingestion

477 intramuscular; intravenous: 2 min

478 endogenous plasma epinephrine concentrations in 40 supine resting adults

479 peak plasma levels 1–2 h after ingestion of 50–100 mg

480 prodrug of the active compound eslicarbazepine

481 in one case 200 mg/L in serum during hospital treatment; 650 mg/L in post-mortem blood

482 under treatment with fomepizole or ethanol during high-efficiency hemodialysis

483 under treatment with fomepizole but without hemodialysis

484 concentration range in 7 fatal ethylone cases

485 seven fatal ethylphenidate cases

486 peak plasma concentrations after 0.5 and 1 mg etizolam, respectively

487 post-transplantation, trough levels of everolimus should be maintained at 3–8 ng/mL when used in combination with other immunosuppressive drugs (calcineurin inhibitor and glucocorticoid) and at 6–10 ng/mL when used without a calcineurin inhibitor. In the treatment of tuberous sclerosis complex, it is recommended that everolimus concentrations should be managed at 5–15 ng/mL

488 prodrug of penciclovir

489 active metabolite fenofibric acid, therapeutic plasma concentration 5–11 mg/L

490 active metabolite amphetamine

491 serum fenitrothion concentrations in n=27 adults who survived poisoning with this chemical

492 prodrug of the active metabolite 5-hydroxymethyl-tolterodine (5-HMT)

493 a single 8 mg oral extended-release dose in 14 healthy adults yielded an average peak plasma concentration of 0.005 mg/L at 5 h; peak plasma levels of 5-HMT in poor cytochrome P450 2D6 metabolizers were appr. twice those in extensive metabolizers

494 as 5-hydroxymethyltolterodine (5-HMT)

495 20 healthy younger adults receiving 1.25 or 5 mg oral doses once daily for 1 week attained average peak plasma levels of 0.001 or 0.0043 mg/L, respectively, at 12 h after the first dose and 0.005 or 0.018 mg/L, respectively, at 12 h after the last dose

496 a single oral 100 mg dose given to n=24 healthy fasting adults resulted in a median peak plasma flibanserin concentration of 0.413 mg/L

497 serum concentration in eight nonfatal poisonings

498 one patient

499 a single oral 0.5 mg dose given to one adult resulted in a peak serum concentration of 8 ng/mL (8 h post-ingestion)

500 19 h after ingestion of 3 mg flubromazolam

501 one patient

502 mg/kg; sum of flunitrazepam and 7-aminoflunitrazepam in 175 persons dying solely from flunitrazepam overdosage

503 n=12 adults arrested for impaired driving

504 ante-mortem; post-mortem 0.48 mg/L

505 in four fatal cases

506 intoxication with AH-7921 and 2-FMA, and other drugs

507 median of 6 case reports: post-mortem 1.3–6.8 mg fluoxetine/L blood and median 2.1 (0.9–5.0) mg norfluoxetine/L blood

508 at 10 h after drug intake under steady state conditions

509 blood flurazepam concentrations in 3 adult deaths due solely to flurazepam

510 concentration suggested by the manufacturer to cause adequate inhibition of alcohol dehydrogenase activity (Antizo® package insert, 1997)

511 2.4–3.2 h after a single 10 mg or 20 mg oral dose

512 as fosinoprilat

513 prodrug of amprenavir

514 2.6–3.1 hours after the last of 40 or 80 mg oral doses twice daily for 2 weeks

515 water soluble prodrug of propofol

516 data from n=13 fatalities

517 prodrug of 4-hydroxybutyrate (GHB)

518 fatalities

519 background blood gold levels in n=130 German citizens: 0.0001 (0.00001–0.0029) mg/L

520 immediate release dosage form; extended release: 10–50 h

521 two children, ages 4 and 5, accidentally given haloperidol doses of 2 and 5 mg p.o.

522 endogenous plasma concentrations in healthy adults

523 the elimination t½ of glycerol depends upon the glycerol concentration (t½ = [G]o/2k); the serum glycerol concentration decreases more rapidly in the late phase of the observation period

524 in poisoned patients

525 post-mortem blood glyphosate levels in n=16 adults who intentionally ingested overdoses; death was strongly associated with greater age, larger ingestions and high plasma glyphosate concentrations on admission (> 734 mg/L)

526 5 fatal cases after abuse by inhalation or ingestion with suicidal intent

527 analytical testing was performed 3 months after autopsy

528 for 6-acetylmorphine, plasma levels in 11 patients 15 min after the end of smoking of 150–400 mg diacetylmorphine (heroin) were 0.068 (0.015–0.156) mg/L, and 0.021 and 0.009 mg/L after 45 and 90 minutes, respectively.

529 nine neurology patients receiving daily oral therapy with 1150–2900 mg hydroxytryptophan plus 200 mg of carbidopa for 8–54 months had steady state peak plasma hydroxytryptophan levels averaging 9.4 (range 3.0–17) mg/L

530 co-administration of carbidopa resulted in a doubling of the elimination half-life of 5-HTP

531 4 h post-ingestion; survived with supportive measures

532 adults with unusually high oral doses of 5 to 75 mg/kg idebenone achieved average peak plasma levels of 1.64–9.53 mg/L

533 7 h post-ingestion

534 a single oral 100 mg dose given to 6 adult male congestive heart failure patients resulted in an average peak plasma concentration of 1.3 mg/L at 1.4 h

535 1 hour after a single oral 200 mg dose to six healthy, younger, fasting men

536 the elimination of isoflurane follows a 3 term exponential decay, with half-lives of 6.7 minutes, 1.3 h, and 58 h representing the vessel-rich, muscle, and fat compartments, respectively.

537 deaths after self-administration of isoflurane

538 the metabolites isosorbide-5-mononitrate (IS-5-MN) and isosorbide-2-mononitrate (IS-2-MN) show pharmacological activity

539 the sublingual administration of 5 mg ISDN to n=6 healthy young man resulted in an average peak plasma concentration of 0.016 mg/L ISMN at 30 minutes; peak plasma levels in n=7 patients receiving chronic high dose therapy (360–720 mg ISDN daily) ranged from 0.046–0.224 mg/L (ISDN), 0.179–0.512 mg/L IS-2-MN, and 0.91-1.97 mg/L IS-5-MN

540 the United Kingdom established a threshold of 0.02 mg/L for blood ketamine as being indicative of impaired driving ability (UK GOV 2014)

541 active metabolite norketotifen

542 active metabolites ortho- and para-hydroxyatorvastatin; reference plasma concentration 0.013–0.043 mg/L and 0.001–0.005 mg/L, respectively

543 active metabolite lovastatin hydroxy acid; reference plasma concentration 0.003–0.018 mg/L

544 active metabolite simvastatin hydroxy acid; reference plasma concentration 0.001–0.009 mg/L

545 (major) active metabolite canrenone

546 metabolites 11-hydroxyyohimbine (active) and 10-hydroxyyohimbine

547 in subclavian blood

548 (active?) metabolite norolanzapine, therapeutic range 0.006–0.024 mg/L

549 metabolites norquetiapine, 7-hydroxyquetiapine, and 7-hydroxy norquetiapine

550 paliperidone (9-hydroxyrisperidone) could be a prescribed antipsychotic (parent drug) and a metabolite of risperidone

551 a case with severe hypoglycemia: serum concentration 1 h after hospital admission; O-desmethyltramadol 1.3 mg/L, N-desmethyltramadol 3.3 mg/L, acetaminophen 109.5 mg/L

552 the ‘gray baby syndrome’ occurs in newborns who develop excessive serum concentrations of the drug

553 serum cathine concentrations in n=19 khat cases of suspected driving under the influence of drugs

554 serum cathinone concentrations in 16 of 19 khat cases of suspected driving under the influence of drugs

555 three days after ingestion of a liquid containing hexavalent chromium (Cr(VI)) and inorganic arsenic (iAs) the total Cr concentrations were 2.18 and 1.07 mg/L in whole blood and plasma, respectively, and 4.54 mg/L Cr(VI) in erythrocytes

556 appr. six h after oral ingestion of 300 mg clindamycine-HCl

557 metabolic precursor of lorazepam (see Table)

558 persons survived 1–3 days before they died

559 in combination with 0.035 mg/L etizolam (see Table) in femoral blood

560 elimination of enflurane follows a 3-term exponential decay, with half-lives of 18 min (17% of the absorbed dose, located in the central compartment), 3.2 h (41% from the muscle tissue compartment) and 36 h (42% from the fat compartment)

561 in femoral blood; in heart blood 14,585 ng/L

562 blood ketamine and norketamine concentrations in n=14 impaired drivers averaged 0.42 (range 0.17-0.85) mg/L and 0.61 norketamine (range 0.19-1.4) mg/L, respectively

563 six healthy women given a single oral 50 mg tablet attained peak plasma levels averaging 0.61 mg/L benzydamine

564 a target range of 3-7 mg/L for the trough serum infliximab concentration was suggested for inflammatory bowel disease patients

565 post-mortem femoral blood concentrations found in four cases where other (illegal) drugs were involved

566 active metabolite N-desmethyltrimipramine (= nortrimipramine)

567 active metabolites O-desmethylvenlafaxine (major) and N-desmethylvenlafaxine

568 active metabolite N-desmethylenzalutamide

569 high dose therapy in cancer patients

570 enantiomer of milnacipran (see Table)

571 active metabolites monoethylglycinexylidide (MEGX) and glycinexylidide (GX)

572 active metabolite desipramine, $t_{½}$: 15–25 h (see Table)

573 active metabolite norlorcainide, $t_{½}$: 28 h, therapeutic plasma concentration appr. –1.5 (-2) mg/L

574 (minor) active metabolite lorazepam

575 post-mortem (3 days post-admission)

576 depending on the route of administration

577 endogenous level

578 depending on the dose protocol and leucovorin application; minimal cytotoxic concentration appr. 0.01 µmol/L (= appr. 0.005 mg/L)

579 24 h, 48 h, and 72 h after high-dose i.v. infusion, target concentrations < 10 µmol/L (4.6 mg/L), < 1 µmol/L (0.46 mg/L), and < 0.1 µmol/L (0.046 mg/L), respectively

580 active metabolite of MDMA

581 major metabolite 5-methylpyrithyldione

582 nonenzymatically transformed to 2,2-dichlorvinyl-dimethyl-phosphate (dichlorvos, DDVP) (see Table)

583 maximum plasma concentration after applying 2 mg of sunscreen (spray or lotion) per 1 cm^2 to 75% of body surface area at 0 h on day 1 and 4 times on day 2 through day 4 at 2-h-intervals (each n=12 healthy volunteers)

584 major and active metabolite O-desmethyltramadol; further metabolites N-desmethyltramadol and N, O-didesmethyltramadol

585 steady state after Kratom tea for 7 days in nine chronic, regular, healthy users

586 in case one, plasma moclobemide was 2.8 mg/L with 1.8 mg/L clomipramine; in case two plasma moclobemide 18 mg/L; in case three 60.9 mg/L; none of the patients showed serious effects during 24 h of observation. Plasma moclobemide at 10 to 30 times therapeutic was not associated with major toxic effects; see eg. ref. [516].

587 actve metabolite of the prodrug moexipril

588 in unexposed adults

589 sum naltrexone and 6ß-naltrexol

590 measurement of serum netilmicin concentrations, with maintenance within the ranges 6 to 10 mg/L (peak) and 0.5 to 2 mg/L (trough), are desirable

591 active metabolite N-desethyloxybuti(y)nin; therapeutic plasma concentration 0.01-0.08 mg/L

592 active metabolite 6-oxymorphol

593 neutropenia is related to the duration that plasma concentrations were ≥ 0.05 µmol/L or > 0.1 µmol/L

594 elimination of bisphosphonates is extremely slow, and their terminal half-life can be as long as 10 years in humans

595 the use of a nomograph/nomogram relating plasma drug concentration, time since ingestion and hepatotoxicity is helpful in evaluating the need for antidotal treatment, see eg. ref. [1148, 1149]

596 paraoxon is the active metabolite of parathion

597 active metabolites 7-hydroxypericyazine and pericyazine sulphoxide

598 also an active metabolite of thiopental

599 58-year-old woman who ingested 26 g of naproxen in a suicidal attempt and developed cardiovascular shock, hypocoagulability and thrombopenia

600 active metabolite perindoprilat

601 whole blood concentration

602 monitoring and management of therapy by International Normalized Ratio (INR) and by the thromboplastin time (Quick test)

603 for invasive aspergillosis

604 active metabolite N-desalkylquetiapine (= norquetiapine, $t_{½}$: 10–13 h); therapeutic plasma concentration 0.1–0.25 mg/L

605 given to cancer patients in a phase I study

606 controlled anesthesia

607 active enantiomer of racemic modafinil

608 as modafinil

609 major active metabolite of acetylsalicylic acid

610 C_{max}; six healthy adults inhaled a single high dose of vaporized salvinorin A (n=4, 21 µg/kg; n=2, 18 µg/kg body weight)

611 asymptomatic silver workers

612 16 h post-ingestion of 1700 mg sitaglipin

613 mixed intoxication with several other drugs and ethanol

614 peripheral blood (urine: 88 mg/L), plus 0.58 mg oxycodone/L blood

615 C_{max} at 2 h

616 in non-exposed citizens

617 active metabolite quinalaprilat, therapeutic plasma concentration 0.6–1.8 mg/L

618 as quinalaprilat

619 active metabolite trandolaprilat, therapeutic plasma concentration 0.001–0.006 mg/L, $t_{½}$: 16–24 h

620 peak plasma concentration

621 active 3-hydroxymethyl metabolite, $t_{½}$: 13–15 h

622 $t_{½}$ 10–12 h for the metabolite trichloroethanol and 70–85 h for the metabolite trichloroacetic acid

623 $t_{½}$ 12–13 h for the metabolite trichloroethanol and 86–99 h for the metabolite trichloroacetic acid

624 the plasma concentration of the active metabolite 3-desacetylvecuronium ($t_{½}$: 2 h) may exceed that of vecuronium

625 $t_{½}$ of the metabolite O-desmethylvenlafaxine: 10–20 h

626 post-mortem baseline zinc concentrations: 4.0–8.7 mg/L

627 whole body

628 peak plasma concentrations at end-of-infusion after doses of 4–16 mg

629 at 1–3 h

630 at 1.5–2 h

631 active metabolite 4-(4-guanidinobenzoyloxy)phenylacetic acid

632 C_{max} and $t_{½}$, respectively, after a single oral 200 mg camostat mesilate dose in five healthy adults

633 as arsenious acid, after infusion of arsenic trioxide

Abbreviations: appr. approximately, *AUC* area under the (blood plasma concentration-time) curve, C_{max} maximum (peak) plasma/serum concentration, C_{min} minimum (trough) plasma/serum concentration (usually at steady state), *h* hour/hours, *ICU* intensive care unit, *min* minutes, *mol wt* molecular weight, *ref.* reference(s), *SD* standard deviation, $t_{½}$ terminal elimination half-life (if not stated otherwise), t_{max} time to peak concentration (C_{max})

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