

List of Biological Toxins

Acute Toxins

Biological toxins are hazardous substances produced by microorganisms, animals, insects, and plants that can be harmful when inhaled, ingested, injected, or absorbed. Depending on the toxin and amount and route of exposure, health effects can range from minor (skin or eye irritation, headache, nausea) to severe (respiratory distress, muscle weakness, seizures, death).

Toxins with a mammalian LD50 ≤ 100 $\mu\text{g}/\text{kg}$ body weight, called “acute toxins”, pose the greatest risk. They are highly toxic in minute quantities, have no established safe exposure limits, and there is limited toxicological data applicable to human exposures.

Laboratory exposure risks are primarily from accidental injection, absorption through skin or mucous membranes, inhalation, and ingestion. Most acute toxins are stable proteins (or carbohydrates) requiring rigorous inactivation of contaminated surfaces, objects, and waste.

Higher risk procedures:

- Use of aerosol or splatter generating procedures (e.g. vortexing, grinding, centrifuging, intra-nasal inoculation of animals).
- Utilization of concentrated stocks or large quantities of toxins: beware that a vial could contain more than a LD50 for an average-sized person! Calculate in advance.
- Work with powdered or dried toxins: potential for inhalation and a tendency for electrostatic attachment to gloves, weighing spatulas, etc.
- Use of needles or sharps in experimental procedures
- Reconstitution of lyophilized toxin:
 - Highly concentrated material
 - Sealed vials that are difficult to open (glass breakage, sharp metal band)
 - Removal of septa may result in dispersal of concentrated powder.
 - Alternatively, puncturing the septum with a needle and syringe provides potential for sharps injuries.

Registration of Projects Involving Acute Toxins

All acute toxins must be registered with the Marshall University Institutional Biosafety Committee by completing the rDNA Infectious Agent Form and the Biological Toxin/Select Agent Forms. In addition to the registration forms, you must also submit lab-specific Standard Operating Procedures (SOPs) for work with and handling of acute toxins at the time you submit your acute toxin registration document. You cannot begin work with the toxin until your project and SOPs have been approved.

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Toxin Table (Toxins in **bold** are Select Agent toxins.)

	Species	Route	LD50 (µg/kg body weight)
Abrin	Mouse Human	IV Ingestion	0.7 5-7
Aerolysin	Mouse	IV	7*
Botulinum Toxin A	Mouse	IP	0.0012*
Botulinum Toxin B	Mouse	IP	0.0012*
Botulinum Toxin C1	Mouse	IV	0.0011
Botulinum Toxin C2	Mouse	IP	0.0012
Botulinum Toxin D	Mouse	IP	0.0004
Botulinum Toxin E	Mouse		0.0011*
Botulinum Toxin F	Mouse	IV	0.0025
B-Bungarotoxin	Mouse Mouse	IP IV	7.8 10
Caeruleotoxin	Mouse	IV	40
Cereolysin	Mouse	IV	40–80
Ciguatoxin 2	Mouse	IP	1
Ciguatoxin 3	Mouse	IP	0.9
<i>Clostridium difficile</i> enterotoxin A	Mouse	IP	0.5
<i>Clostridium perfringens</i> alpha toxin, lecithinase	Mouse	IV	3
<i>Clostridium perfringens</i> theta toxin, perfringolysin O	Mouse	IV	13-16
<i>Clostridium perfringens</i> enterotoxin	Mouse	IV	81
<i>Clostridium perfringens</i> beta-toxin	Mouse Mouse	IP IV	4.5 0.31
<i>Clostridium perfringens</i> delta-toxin	Mouse	IV	5*
<i>Clostridium perfringens</i> epsilon-toxin	Mouse		0.1*
Conotoxins			10-100
Crotoxin	Mouse	IV	82
Diacetoxyscirpenol (DAS)[#]	Dog	IV	1100
Diphtheria toxin	Mouse Hamster	IV IP	0.01 6.5
Listeriolysin	Mouse		3-12*
Maitotoxin	Mouse	IP	0.6
Modeccin	Rat	IP	1.3
Nematocyst toxins	Mouse	IV	33-70
Notexin	Mouse	IV	5
Palytoxin	Rat Mouse	IV IP	0.089 0.05

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Pertussis toxin	Mouse	IP	18
Pneumolysin	Rabbit	IV	1.5
<i>Pseudomonas aeruginosa</i> exotoxin A	Mouse	IP	14
	Mouse	IV	3
Ricin	Mouse	IV	2.2
	Rat	IP	1.5
Saxitoxin	Mouse	IV	3-9
Scaritoxin	Mouse	IP	50
Shiga toxin	Mouse	IP	0.25
	Rabbit	IV	0.0022
<i>Shigella dysenteriae</i> neurotoxin	Mouse	IP	1.3
	Mouse	IV	0.45
Streptolysin O	Mouse	IV	8
Streptolysin S	Mouse	IV	25
<i>Staphylococcus aureus</i> alpha toxin	Mouse	IV	0.04-0.06
<i>Staphylococcus aureus</i> enterotoxin B	Monkey	IV	20
<i>Staphylococcus aureus</i> enterotoxin F	Rabbit	SubQ	2
	Rabbit	IV	10
T-2 toxin[#]	Pig	IV	1000
Taipoxin	Mouse	IV	2
Tetanus toxin	Mouse	SubQ	0.003
Tetrodotoxin	Mouse	IV/IP	8
Viscumin	Mouse	IV	2.4
Volkensin	Mouse	IP	1.38
<i>Yersinia pestis</i> murine toxin	Mouse	IV	10

IV = intravenous; IP = intraperitoneal; SubQ = subcutaneous

#Although DAS and T-2 toxins have LD₅₀ values > 100µg/kg body weight, they must be registered as Acute Toxins with the Biosafety Office due to the fact that they are Select Agent toxins.

*MLD = minimum lethal dose; lowest dose reported to kill at least one subject