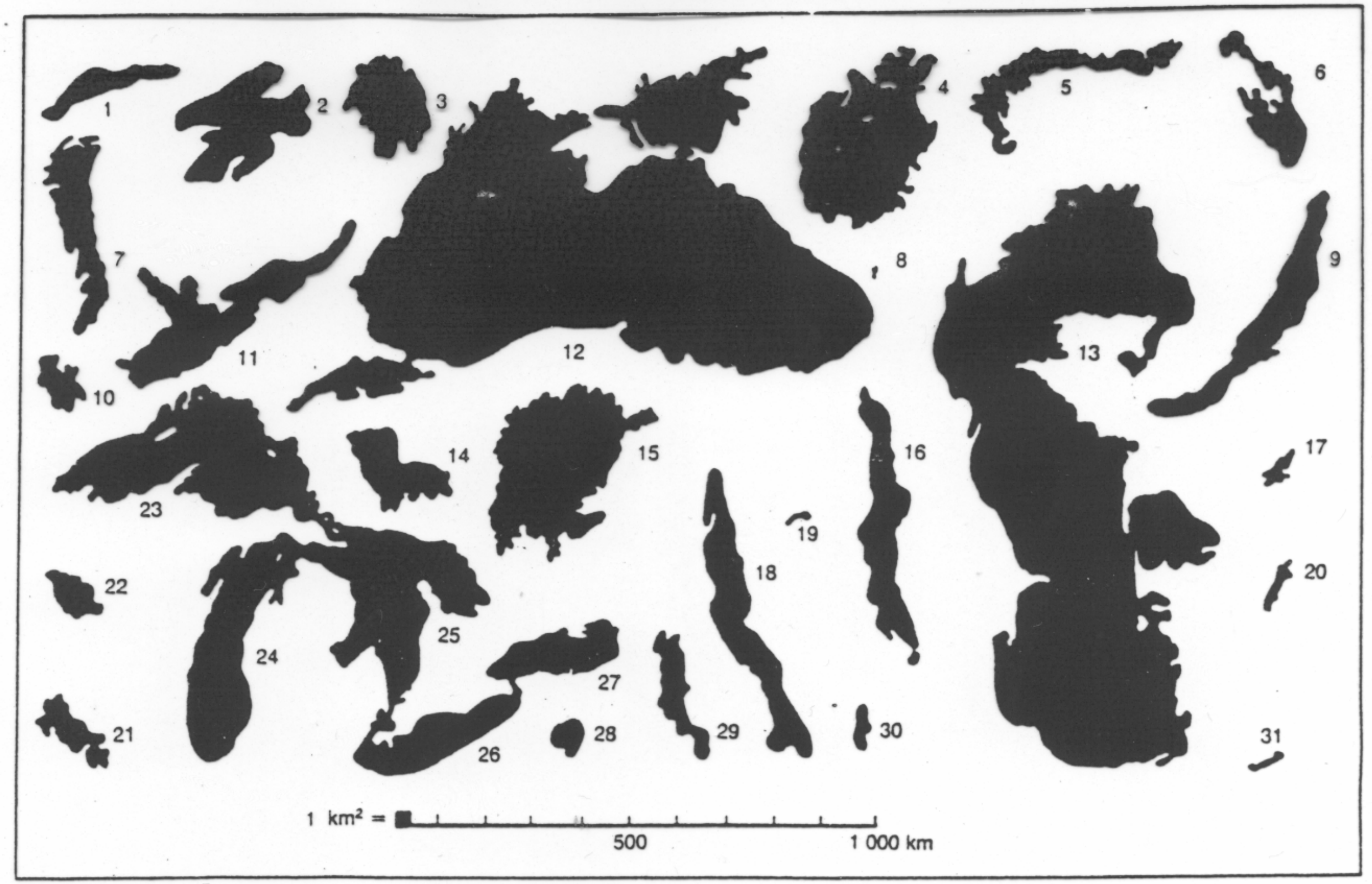
Ekotoxikologie vodních ekosystémů

Úvod

Tabulka 1

Rozložení vody v biosféře (podle různých autorů sestavil Wetzel, 1983)

	Objem v tis. km^3	%	Doba obnovení
oceány	1 370 000	97,61	37 000 roků
polární led a ledovce	29 000	2,08	16 000 roků
podzemní voda (volně pohyblivá)	4 000	0,29	300 roků
sladkovodní jezera a jiné nádrže	125	0,009	1–100 roků
slaná jezera	104	0,008	10–1000 roků
půdní vlhkost	67	0,005	280 dnů
řeky	1,2	0,000 09	12–20 dnů
atmosférická vlhkost	14	0,000 9	9 dnů



Rozloha některých velkých kontinentálních vodních nádrží (vše ve stejném měřítku): 1 jezero Athobaska, 2 Velké Medvědí. 3 Ladoga, 4 Aralské. S Balkaš, 6 Oněga, 7 Winnipeg, 8 Neusiedlerské, 9 Bajkal, 10 Velké Solné. 11 Velké Otročí, 12 Černé moře, 13 Kaspické moře, 14 jezero Čad, 15 Viktoriino, I6 Njasa, 17 Innaren. 18 Tanganjika, 19 Ženevské, 20 Vättern, 21 Titicaca, 22 Nicaragua, 23 Hořejší. 24 Michigan, 25 Huron. 26 Erie. 27 Ontario, 28 Tana, 29 Rudolfovo. 30 Mrtvé moře, 31 Balaton

Ekotoxikologie ekosystémů:

- Povrchových vod
  - Stojaté (lenitické)
    - Přírodní jezera, tůně
    - Přehrady (vodárenské, rekreační, technologické)
    - Rybníky, mokřady
  - Tekoucí (lotické)
    - Prameniště, potoky, řeky
- Podpovrchové a podzemní vody

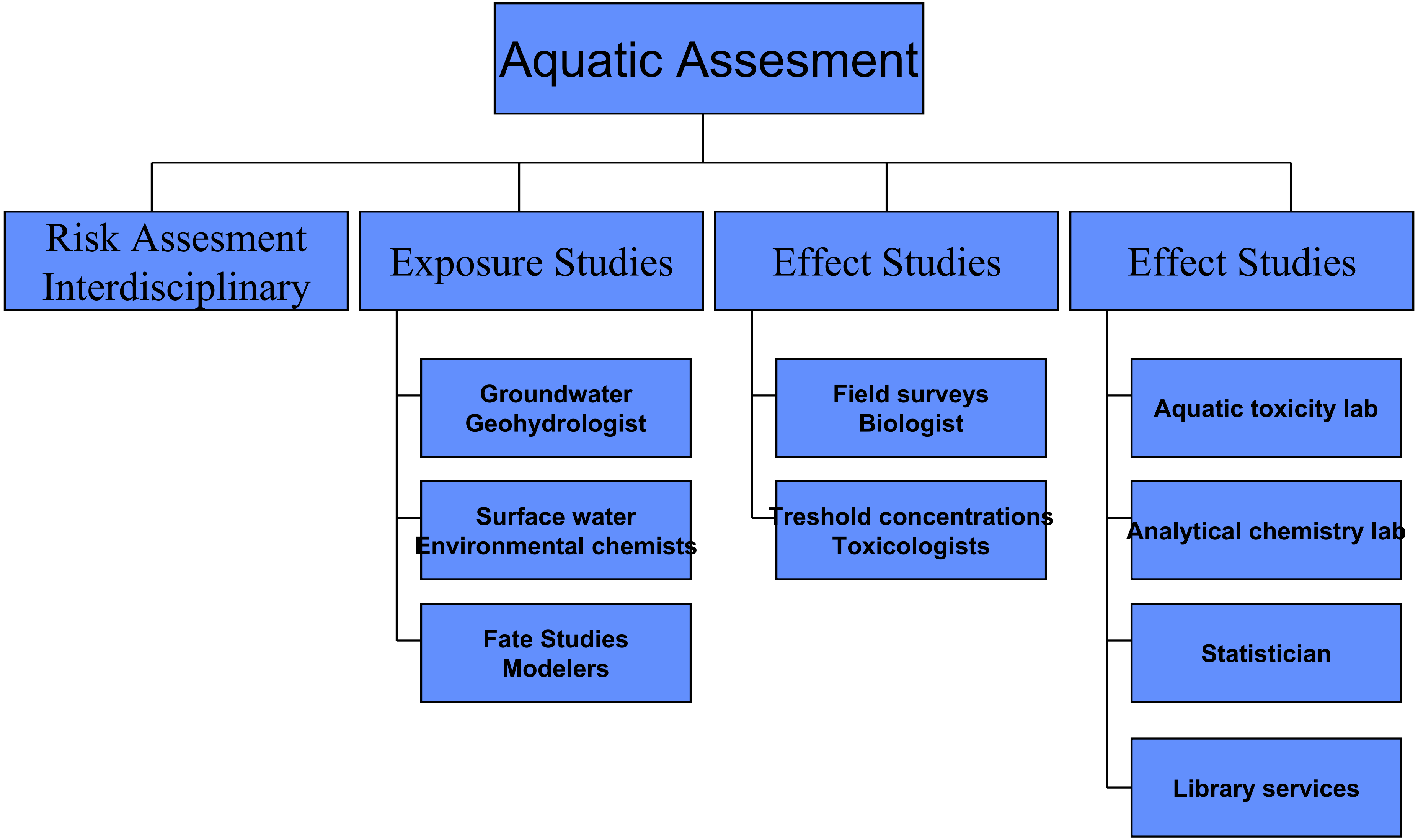
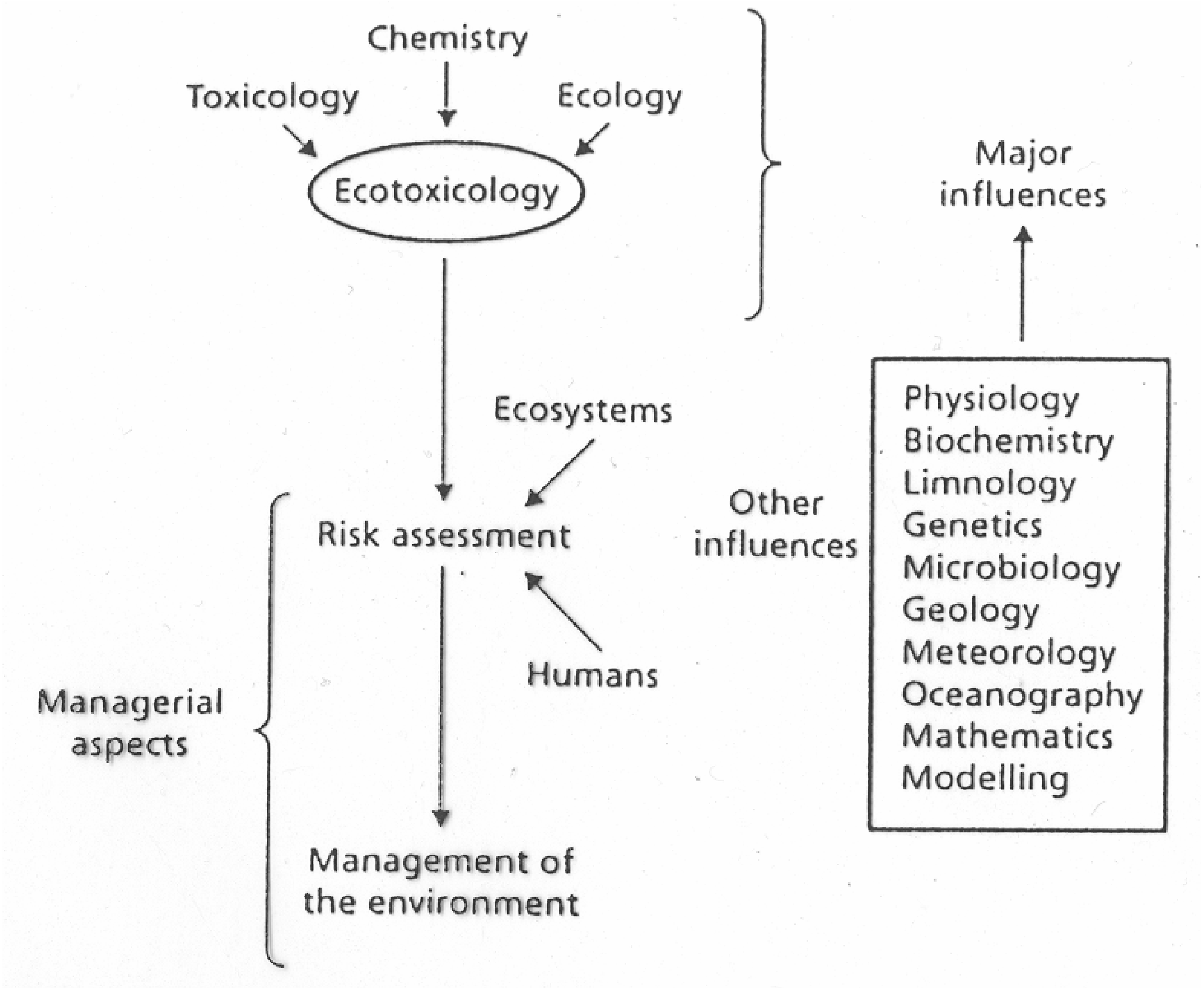


Figure 1. Interdisciplinary team structure for typical aquatic assesment



Komponenty oboru Ekotoxikologie vodních ekosystémů

Aquatic Toxicology

Integrated Processes

- Toxicity testing
- Chemical meaurement
- Statistical analyses
- Structure-activity relationships
- modelling

BIOLOGICAL STRUCTURE/FUNCTION

- AQUATIC ECOLOGY
- BEHAVIOR
- PHYSIOLOGY
- HISTOLOGY
- BIOCHEMISTRY

ENVIRONMENTAL CONCENTRATION (DISTRIBUTION/FATE)

PHYSICAL FACTORS

- MOLECULAR STRUCTURE
- SOLUBILITY
- VOLATILITY
- SORPTION

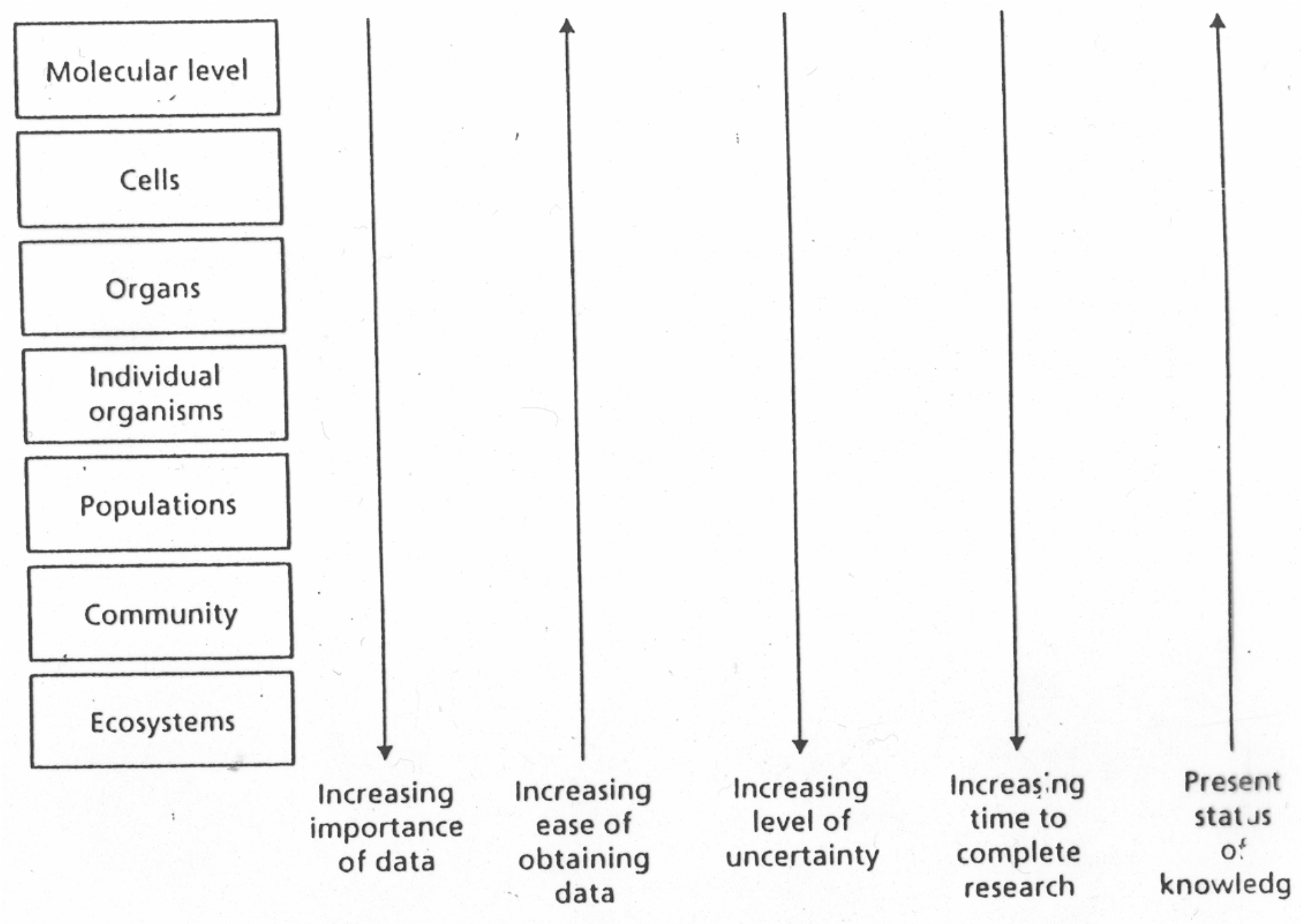
CHEMICAL FACTORS

- HYDROLYSIS
- PHOTOLYSIS
- OXIDATION/ REDUCTION

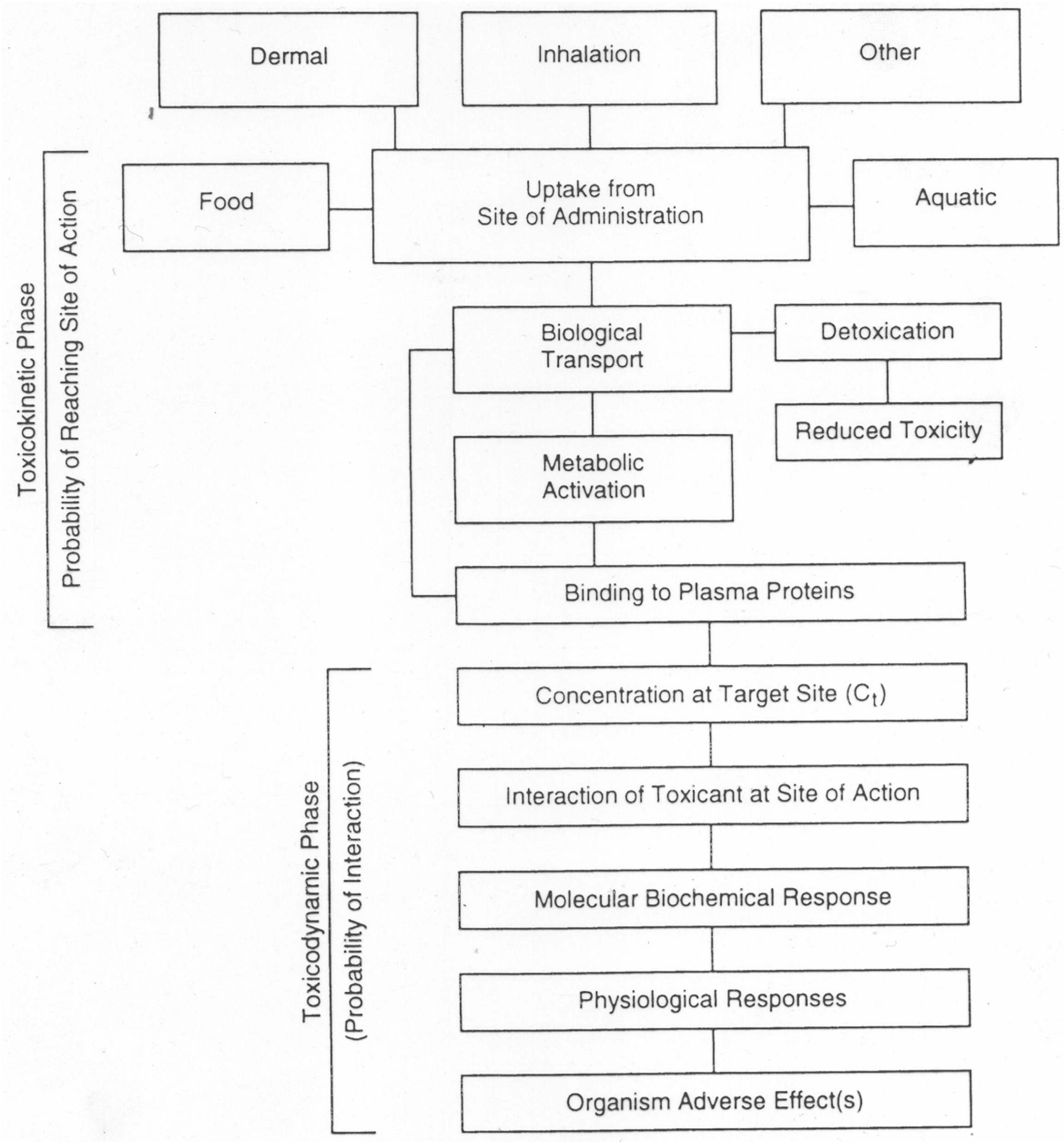
BIOLOGICAL FACTORS

- BIOACCUMULATION
- BIOTRANSFORMATION
- BIODEGRADATION

Ekotoxikologie vodních ekosystémů je multidisciplinární věda



Relationships of aspects of the science of ecotoxicology and different levels of biological organisation



Overview of processes controlling toxicity within an organism.

In the toxicokinetic phase, the **organism is exposed to a substance by various routes:** food, aquatic uptake, dermal, inhalation, etc. The substance is then transported within the organism and can be detoxified (leading to reduced toxicity). metabolically activated (leading to increased toxicity, or expressed directly as the original substance. In the process of reaching the target site (toxicodynamic phase, which involves probability of interaction), binding can occur to plasma proteins that reduces the blood concentration. Once reaching the target site (C,) interaction can take place leading to a molecular biochemical response (receptor interaction), which **produces a cascade of physiological responses leading ultimately to observed whole-organism adverse effect(s).**

BIOLOGICKÉ SYSTÉMY V EKOTOXIKOLOGII

Chemická látka vstupuje do živého systému a má charakteristický osud *(organismus ~ další vnější prostředí)*

TOXOKINETIKA / TOXIKOKINETIKA

- příjem / transport / distribuce / metabolismus / eliminace

TOXODYNAMIKA / TOXIKODYNAMIKA

- biochemické interakce s receptorovým místem

Toxikologie látky na různých úrovních

- molekulární, buněčná, orgánová .... organismální

Ekotoxikologie

- efekty na organismální úrovni se projeví na stavu **populace, společenstva**

Table 1. Mammalian toxicology and ecotoxicology differ in many respects

Mammalian toxicology	Ecotoxicology[a]
Objective: to protect humans from exposure to toxic substances and materials at concentrations which are or may be associated with adverse effects	Objective: to protect populations and communities of many diverse species from exposure to toxic substances and materials at concentrations which are or may be associated with adverse effects
Must almost always rely on animal models (e.g., rat, mouse, guinea pig, rabbit) since experimentation with humans is not feasible	Can experiment directly on species of concern (although there may be uncertainty on whether the most appropriate "indicator" or "sensitive" species is used)
Species of interest (man) is known; thus degree of extrapolation is more certain	Not able to identify and test all species of concern; thus, degree of extrapolation is uncertain. Organism responses and toxicity may be different in more complex natural systems because of bioavailability of chemical, organic matter concentrations and other environmental interactions
Test organisms are homeothermic or warm-blooded (body temperature is relatively uniform and nearly independent of environmental temperature); thus, toxicity is predictable	Test organisms (aquatic) live in a variable environment and most are poikilothermic or cold-blooded (body temperature varies with the environmental temperature), birds and aquatic mammals being the exception; thus toxicity may not be sufficiently predictable
The dose of a test chemical usually can be measured directly and accurately, and may be administered by a number of routes. However, unless "absorbed dose" measurements are made via tissue dosimetry, the typical LD50 (e.g., oral bolus) estimate is an external or exposure dose	The external or exposure "dose" is known in terms of the chemical's concentration in a medium (typically water, but also sediment and/or food) and the length of exposure to it; the actual "absorbed dose" is often determined now experimentally using bioconcentration/bioaccumulation and metabolism studies
Extensive "basic" research has been conducted; emphasis has been on understanding mechanisms of toxic action	Much less "basic" research has been conducted, as emphasis has been on measuring toxic effects and generating media-based threshold concentration data, with an eye toward regulatory needs. More recently, emphasis has been on mechanisms of action and structure-activity relationships
Test methods are well developed, their usefulness and limits well understood	Many commonly used test methods are relatively new and some are formalized (standardized). However, their usefulness in many cases at predicting field impacts and protecting natural ecosystems is often uncertain

[a]Organisms can include aquatic and terrestrial species including plants, invertebrates, fish, birds, and mammalian wildlife.
Adapted from Rand, 1991.