



MEDUWA-Vecht(e) Project 2017-2020

MEDizin Unerwünscht im WAsser / MEDicines Unwanted in WAtEr / MEDicijnen Uit het WAtEr

HCWH Workshop, November 12 2019, Brussels, Belgium



By Alfons Uijtewaal & Margarita Amador

Stichting Huize Aarde

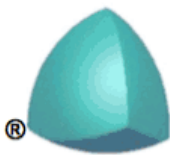
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inter-sectoral cross-border MEDUWA-Vecht(e) coalition



Dr. Eike G. Fischer
Aix Scientifics®
Contract Research Organisation



VitalFluid®



Radboudumc
university medical center



InProSens
Innovative Process Sensors



UNIVERSITY
OF TWENTE.

Radboud Universiteit



budget € 8.5 million

co-funders:



EUROPEAN UNION
European Regional Development Fund



Niedersächsische
Staatskanzlei



Ministerie van Economische Zaken
en Klimaat

Ministerium für Wirtschaft, Innovation,
Digitalisierung und Energie
des Landes Nordrhein-Westfalen



provincie
Gelderland

provincie Overijssel



PROVINCIE FLEVOLAND

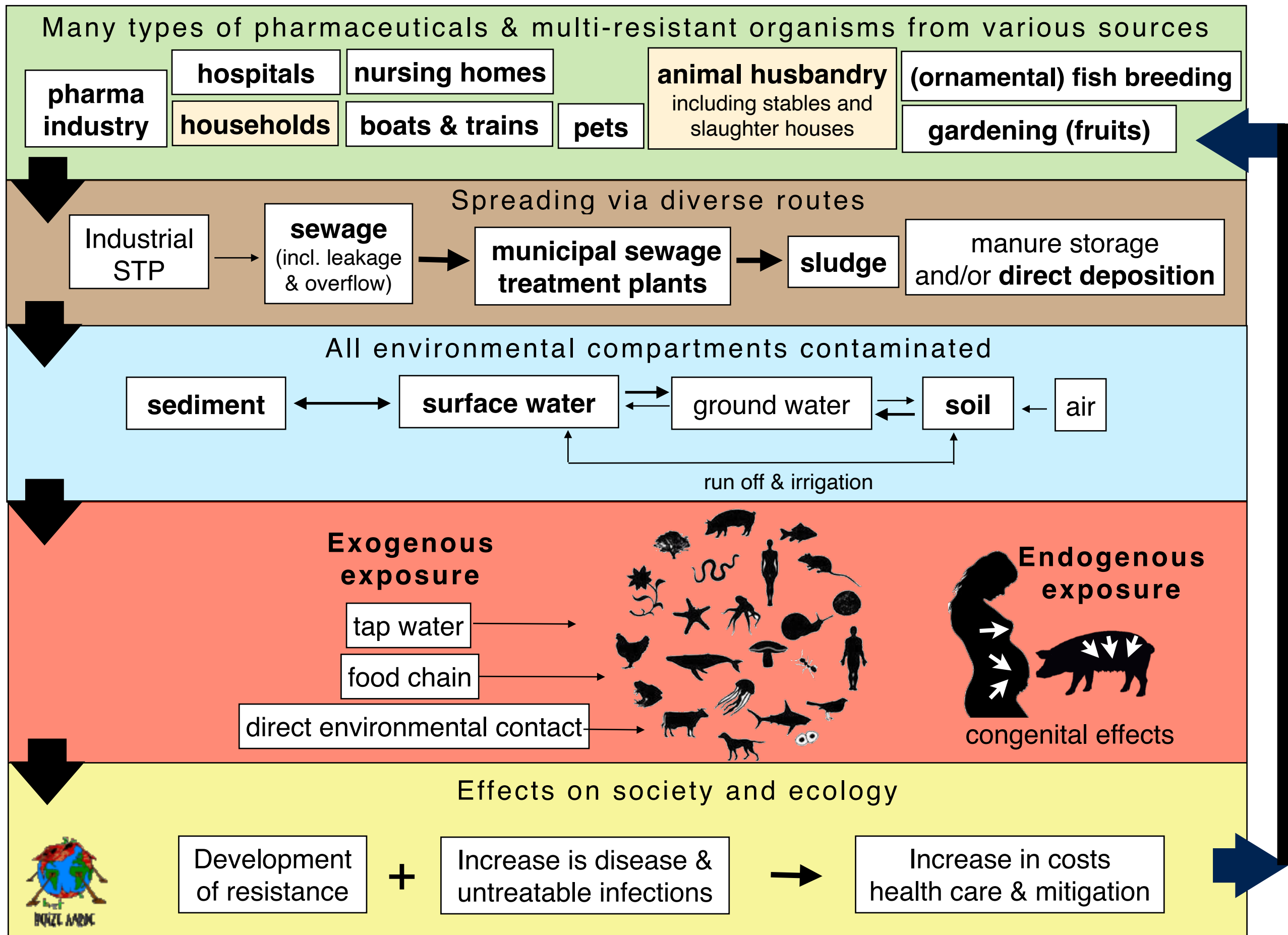
provinsje fryslân
provincie fryslân



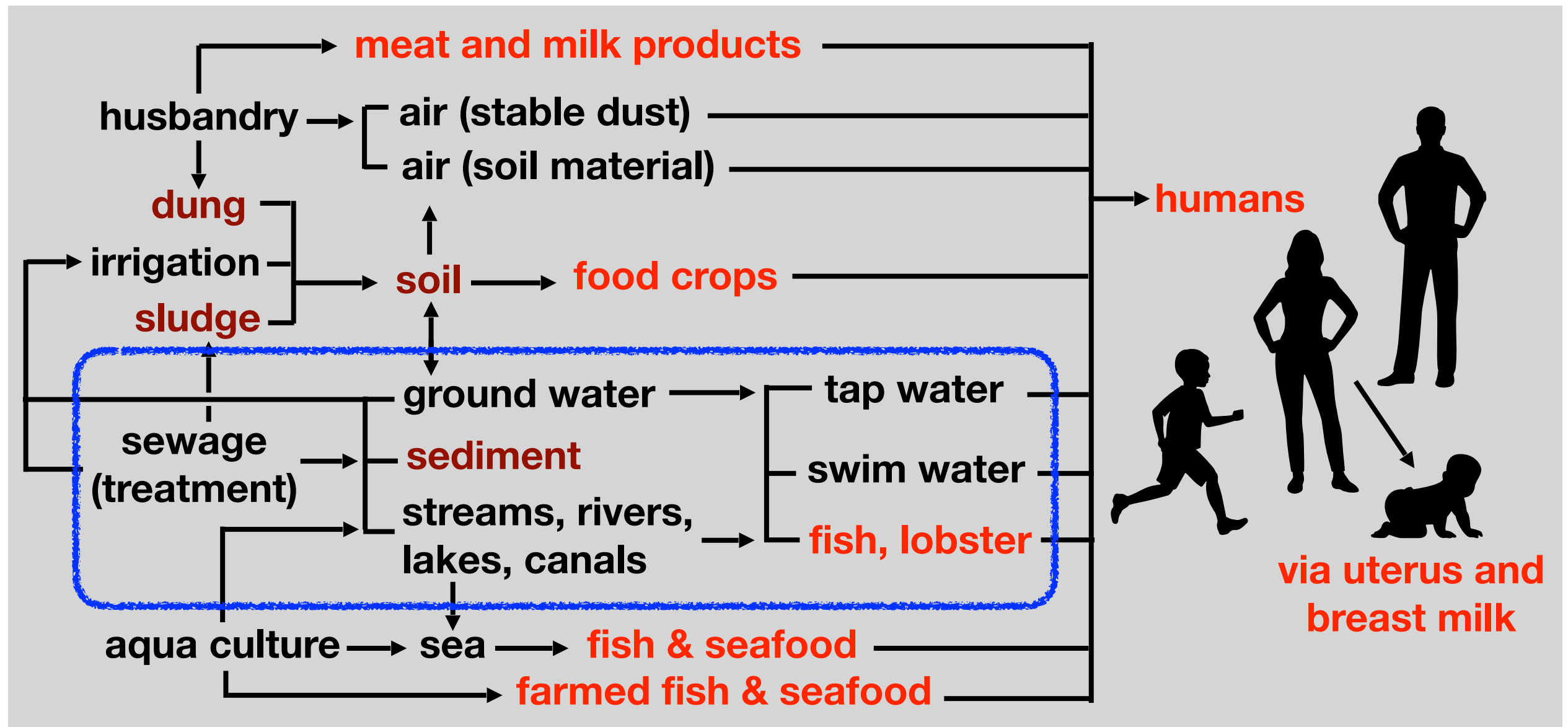
INTERREG
Deutschland
Nederland



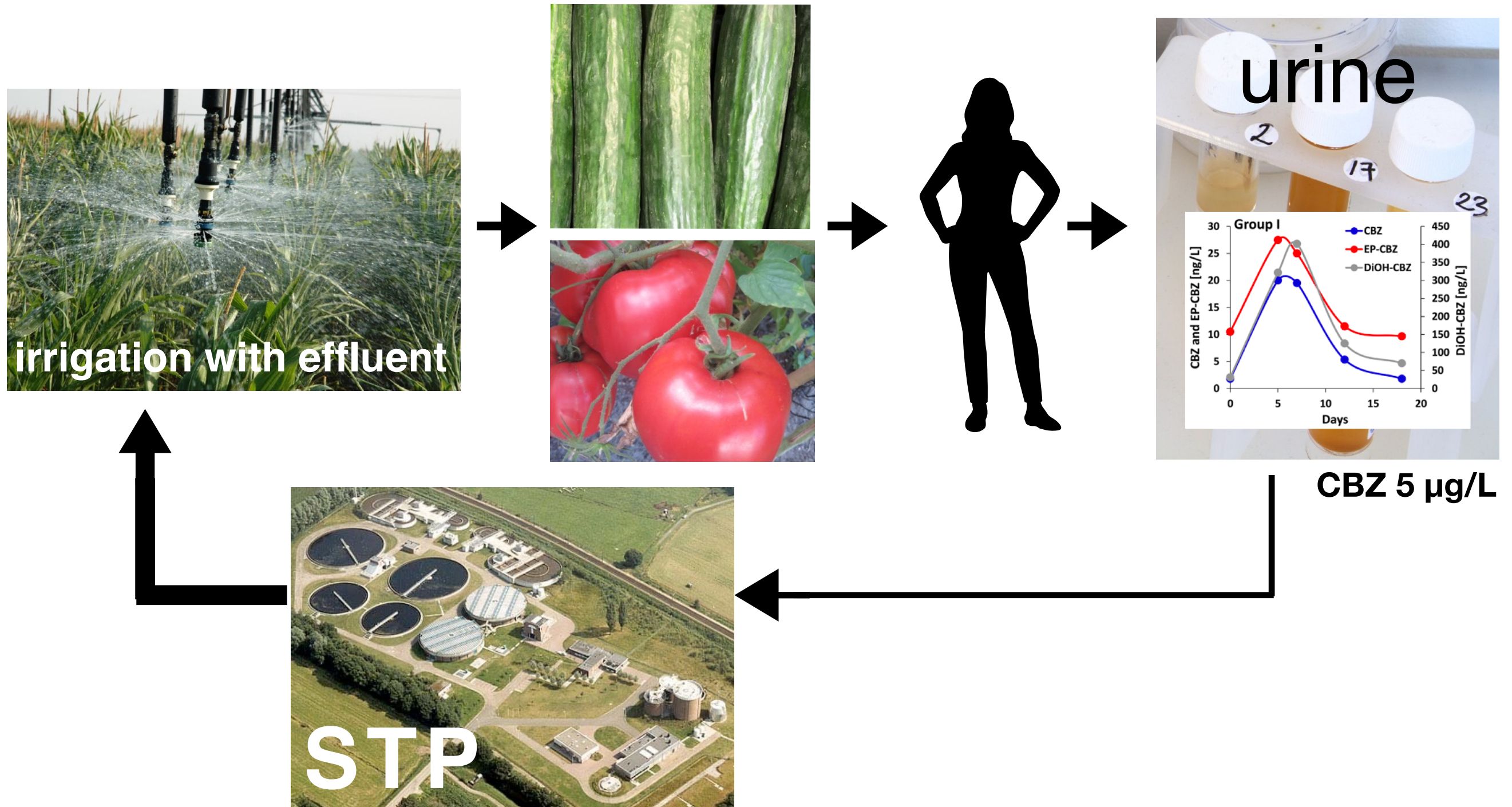
environmental cycle of pharmaceuticals & antimicrobial resistance



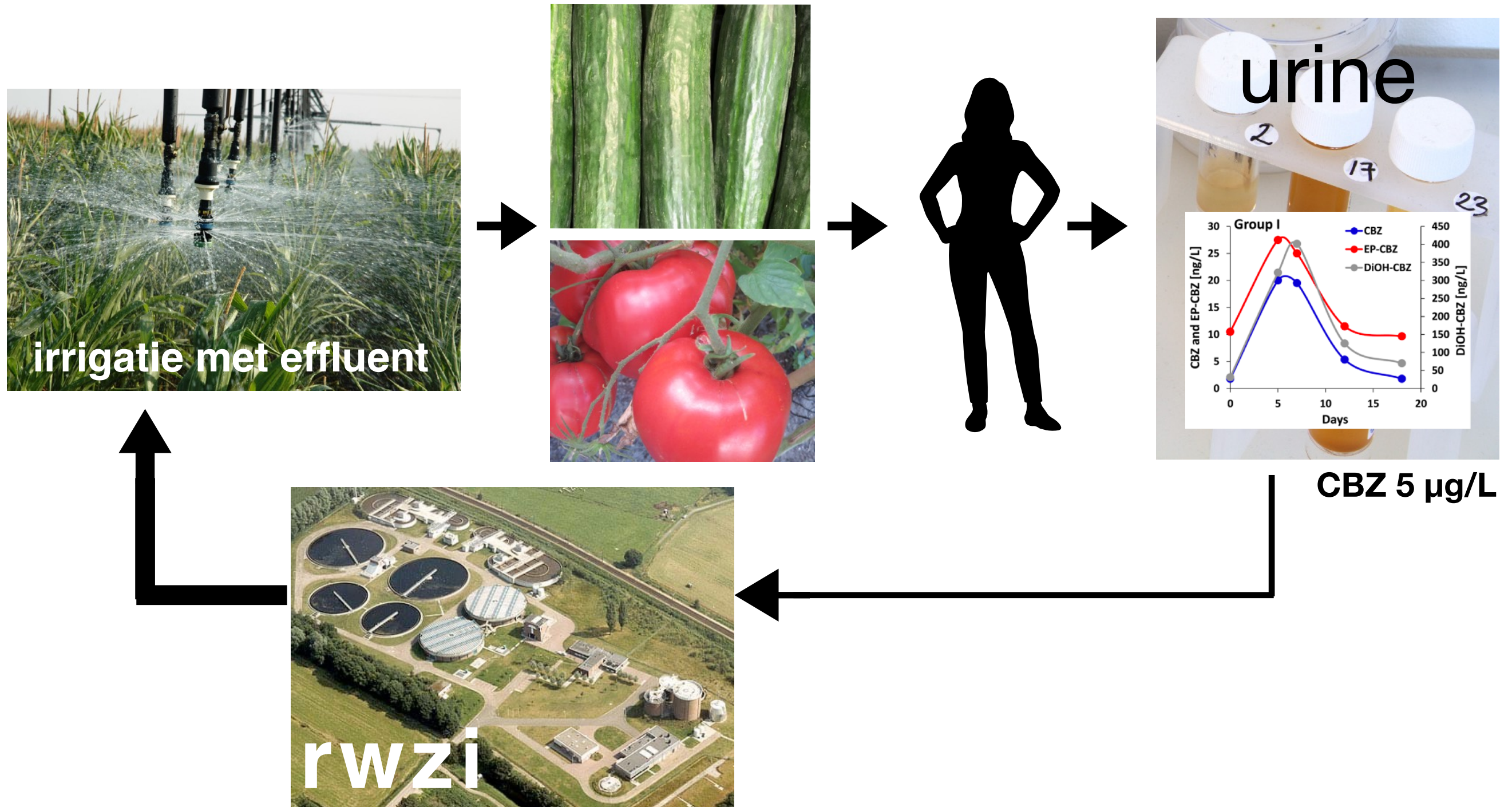
human exposure to medicines and antimicrobial resistance via food, water and air



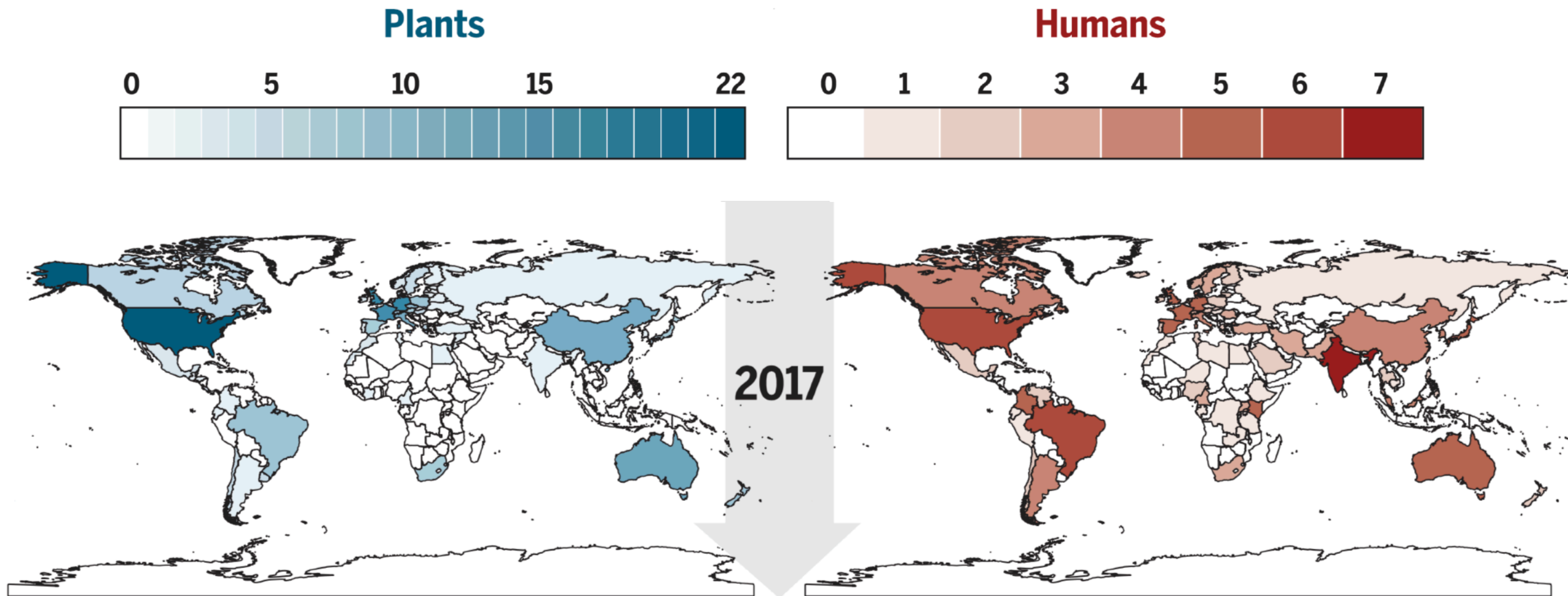
carbamazepine in urine of healthy people



carbamazepine in urine of healthy people



increase in azole resistant fungi in plants and humans

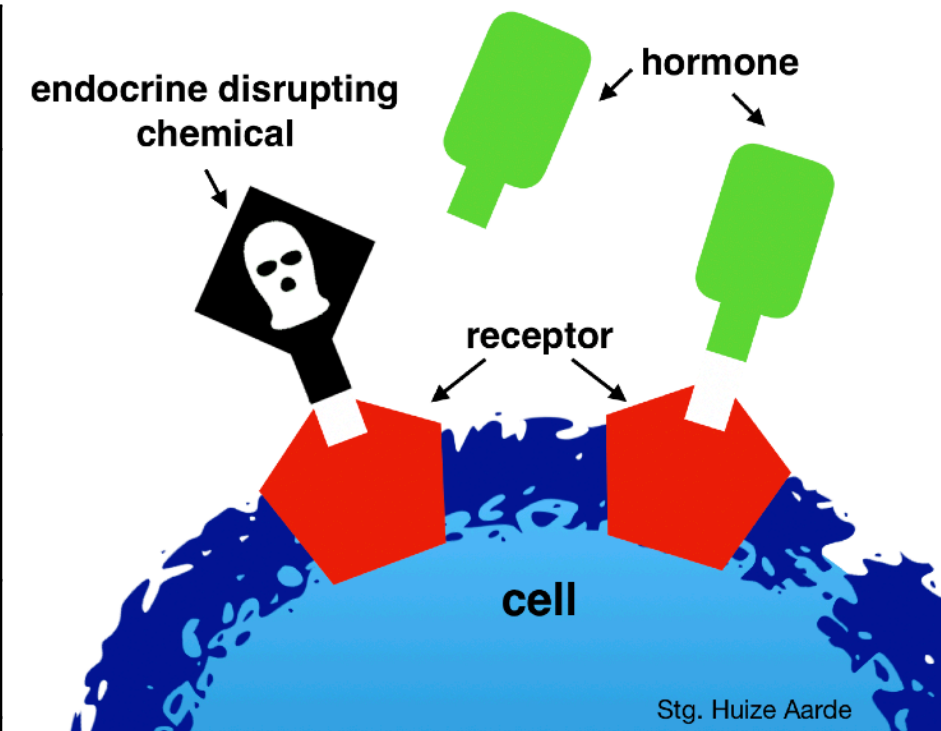


(Sources in) Fisher M. C. et al. 2018

environmental medicines: endocrine disruptors?

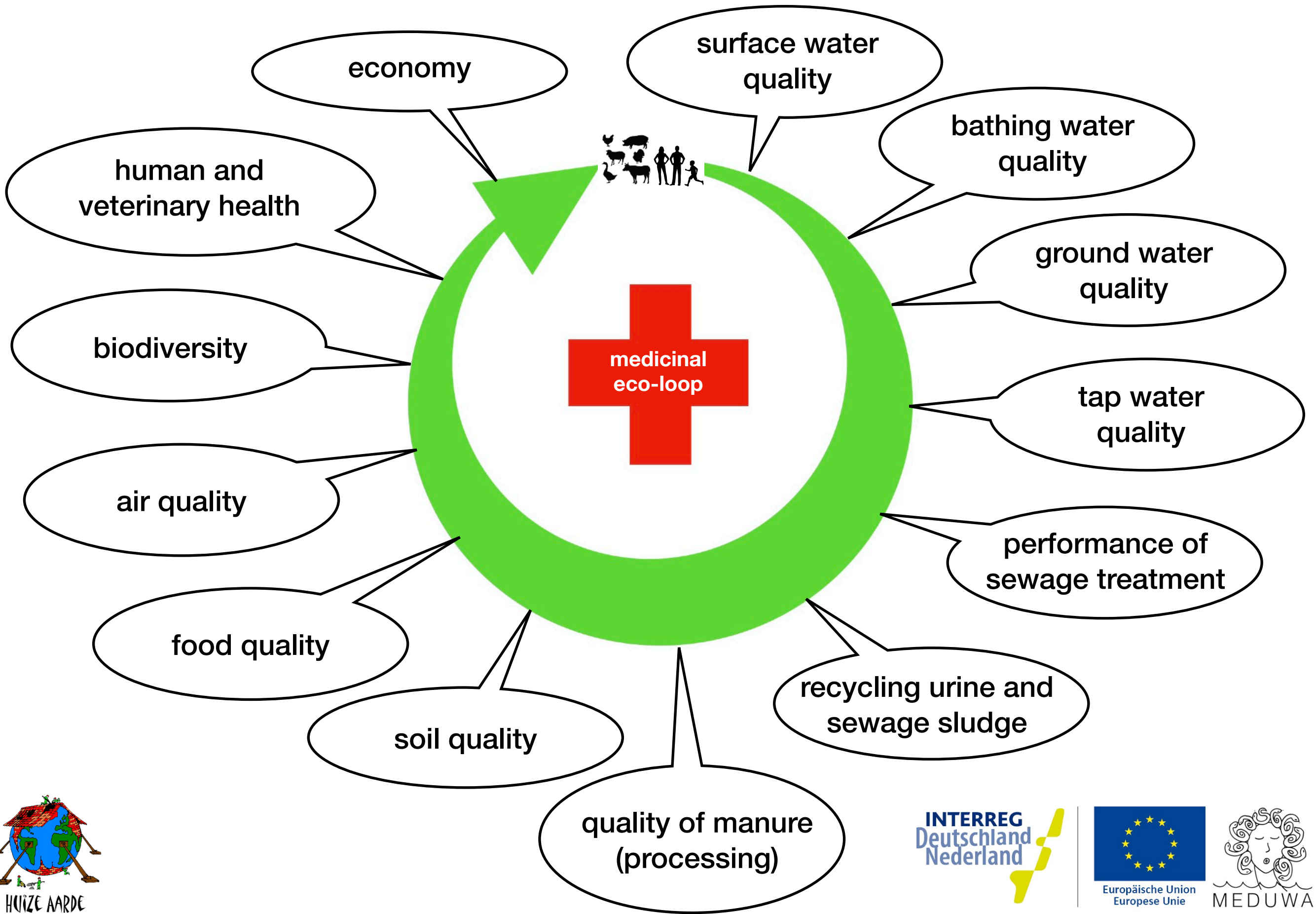
non-hormonal medicines with ED-effect

medicine group	sub group	examples	number studies
analgesics	NSAID	ibuprofen acetaminophen	11
antidepressants	SSRI	fluoxetine sertraline	10
anti-fungal agents	azoles	ketoconazole clotrimazole	7
cholesterol reducers	fibrates	bezafibrate clofibrate	5
antihypertensives	beta-blockers	salbutamol propranolol	4
anti-cancer agents	anti-estrogenics	tamoxifen	2
antihypertensives	diuretics	furosemide	2
antibacterial agents	antibiotics	amoxicillin erythromycin	1
antiepileptics	Na-blocker	carbamazepin	1
antiacids	H2-blocker	cimetidine	1



(based on 30 publications till February 2014, Stg. Huize Aarde)

societal consequences of medicinal environmental cycle



sustainability of measures

by human health sector

by veterinary health sector

advanced drinking water treatment

fermentation or combustion of manure;
oxidation of urine

advanced central sewage treatment

collection of excess medicines

advanced decentralized
sewage treatment

biological degradation
in manure



separating waste streams at source

intelligent fertilization

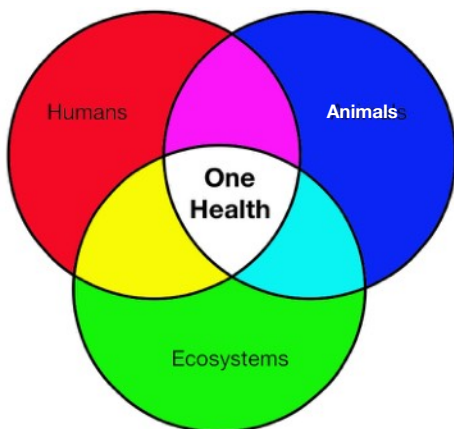


greening of molecules

authorisation on the basis of an
environmental impact assessment

non-chemical diagnosis and treatment

non-chemical diagnosis & treatment



health promotion

vaccination

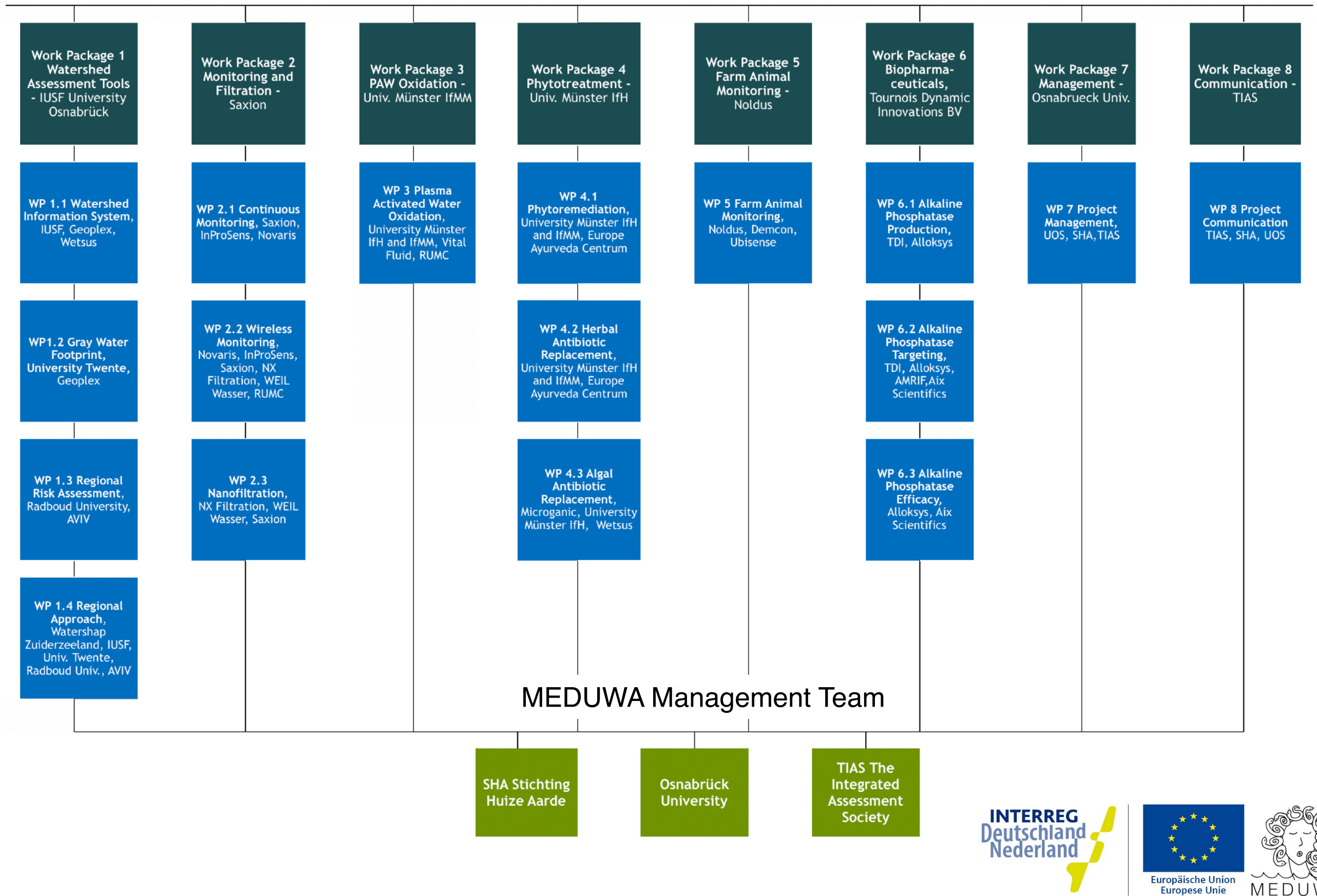
promotion of animal health

reduced meat consumption;
reduction of food waste

Human measures: Jones OAH 2007; Wenzel H et al. 2008
Veterinary measures: Jibichibi B et al. 2007; Eikelenboom D et al. 2012



organogram of the MEDUWA-Vecht(e) Project

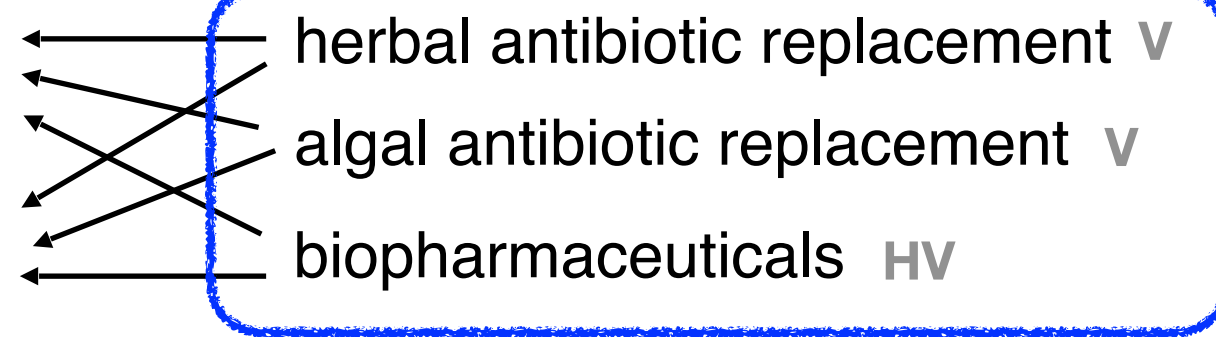
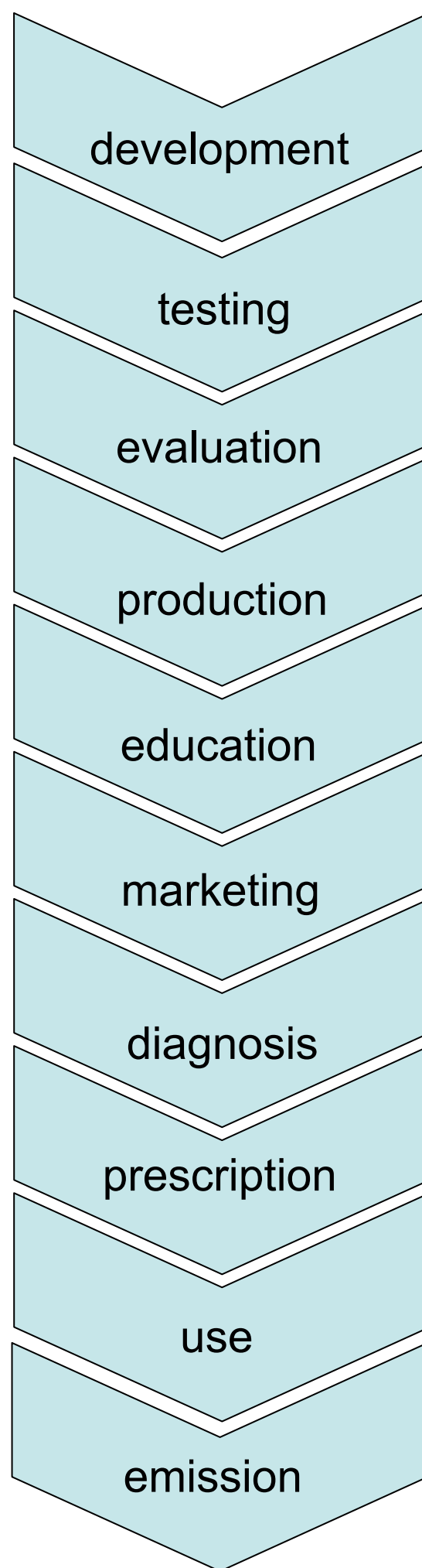


intervention classes of MEDUWA

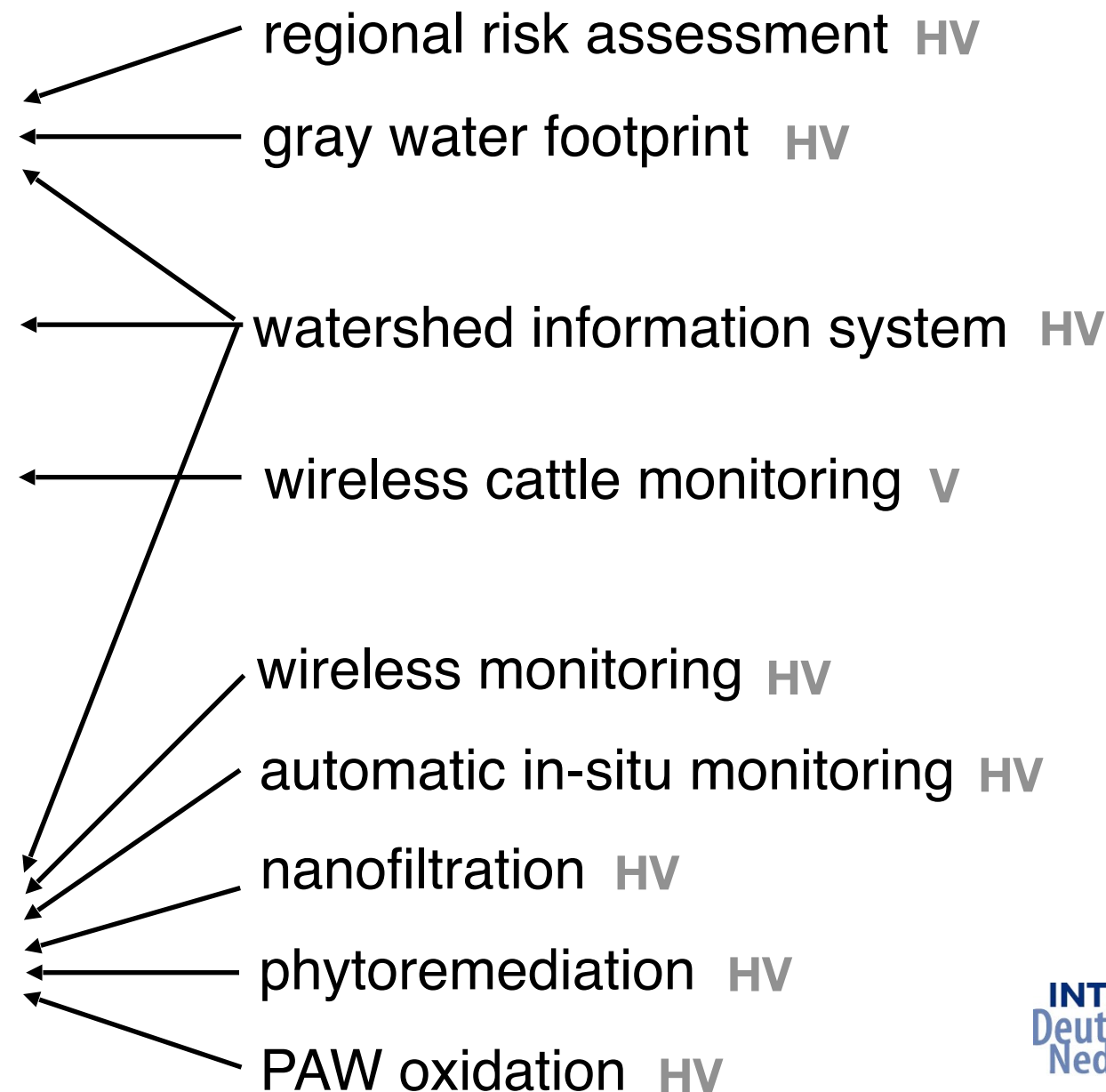
WP	product	prevention	mitigation	monitoring	simulation prediction	visualisation communication
1.1	Watershed info system					
1.2	Gray water footprint					
1.3	Risk assessment					
2.1	Automatic in-situ monitoring					
2.2	Wireless water monitoring					
2.3	Nanofiltration					
3	PAW oxidation					
4.1	Phytoremediation					
4.2	Herbal antibiotic replacement					
4.3	Algal antibibiotic replacement					
5	Wireless cattle monitoring					
6	Biopharmaceuticals					

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focus of today

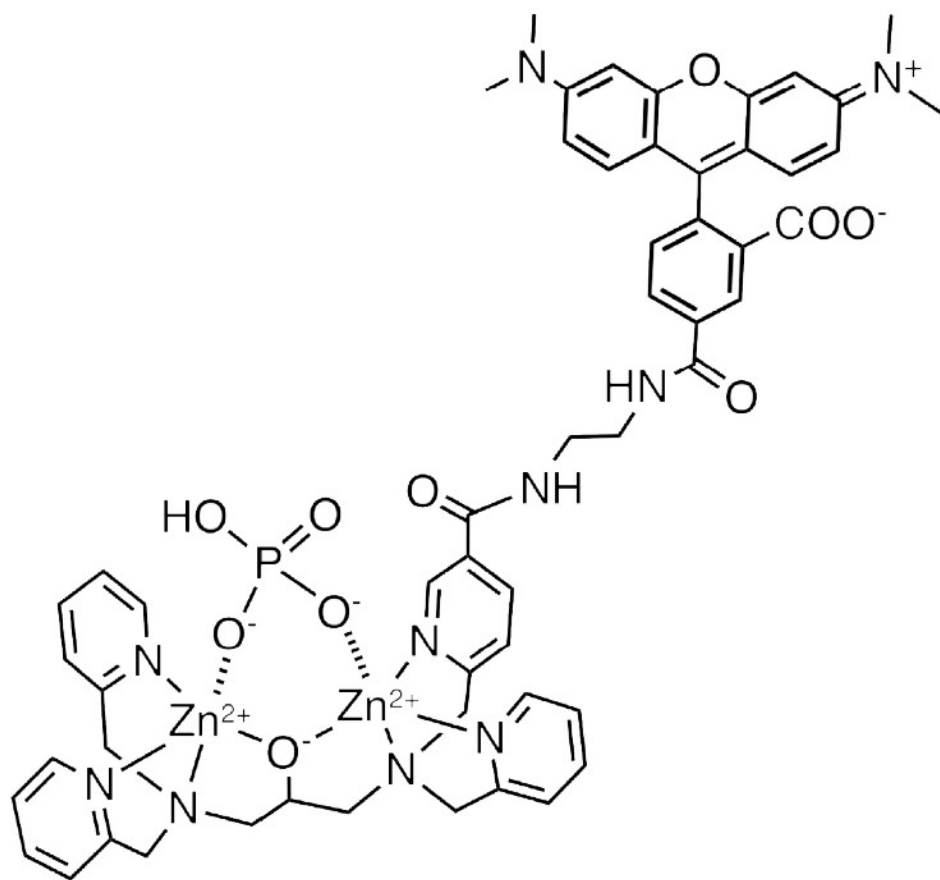


12
innovations
of
MEDUWA

Human
Veterinary



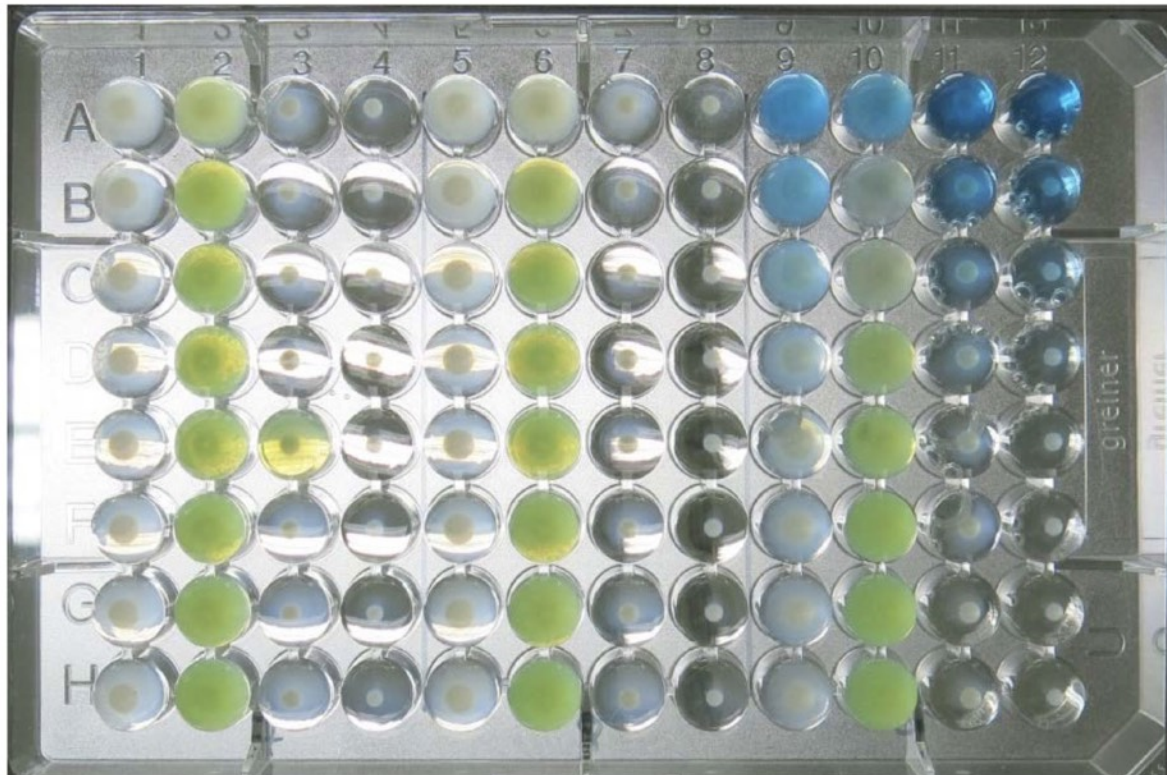
biopharmaceutical : alkaline phosphatase (AP)



- Production and application of AP as a natural anti-inflammatory medicine.
- **In humans:** eg. to prevent steroid use against inflammations in arthritis, cystic fibrosis and during cardiac operations.
- **In animals:** to replace persistent chemicals against mastitis, colitis, weaning diarrhea.



plant and algae mixtures instead of antibiotics



To:

- replace antibiotics in animals and humans
- promote health and growth;
- prevent the contamination of soil, air and water with medicines;
- prevent the development of resistances;
- remediate contaminated water and soil (phytoremediation)



plant and algae mixtures instead of antibiotics

bacterial species

	Bacillus subtilis	S. aureus	E. coli	Ps. aeruginosa
	1:20 – 1:2560	1:20 – 1:2560	1:20 – 1:2560	1:20
	n.e.	n.e.	n.e.	n.e.
	n.e.	1:20 – 1:40	n.e.	n.e.
	1:20 – 1:2560	1:20 – 1:2560	1:20 – 1:2560	n.e.
	1:20 – 1:2560	1:20 – 1:2560	1:20 – 1:2560	1:20 – 1:40
	1:20 – 1:2560	1:20 – 1:2560	1:20 – 1:2560	1:20 – 1:40
	n.e.	n.e.	n.e.	n.e.
	1:20	1:20	n.e.	n.e.
	n.e.	n.e.	n.e.	n.e.
	1:20 – 1:40	1:20	1:20	n.e.
	n.e.	n.e.	n.e.	n.e.
	n.e.	1:20	n.e.	n.e.
	1:20 – 1:2560	1:20 – 1:1280	1:20 – 1:640	n.e.
	n.e.	n.e.	n.e.	n.e.
	1:20 – 1:2560	1:20 – 1:1280	1:20 – 1:1280	1:20
	1:20 – 1:2560	1:20 – 1:1280	1:20 – 1:1280	1:20
	1:20 – 1:160	1:20 – 1:160	n.e.	n.e.
	n.e.	n.e.	n.e.	n.e.
	1:20 – 1:2560	1:20 – 1:2560	1:20 – 1:1280	1:20
	1:20 – 1:2560	1:20 – 1:1280	1:20 – 1:640	n.e.
	1:20 – 1:2560	1:20 – 1:2560	1:20 – 1:2560	1:20
	1:20 – 1:2560	1:20 – 1:2560	1:20 – 1:2560	1:20
	n.e.	n.e.	n.e.	n.e.
	1:20 – 1:2560	1:20 – 1:640	1:20 – 1:320	n.e.
	1:20 – 1:2560	1:20 – 1:1280	1:20 – 1:640	n.e.
	1:20	1:20	n.e.	n.e.
	1:20 – 1:40	1:20 – 1:40	1:20	n.e.
	1:20 – 1:2560	1:20 – 1:1280	1:20 – 1:640	1:20
	1:20 – 1:40	1:20 – 1:80	n.e.	1:20
	1:20 – 1:80	1:20 – 1:80	n.e.	1:20 – 1:40
	n.e.	n.e.	n.e.	n.e.
	1:20 – 1:256	1:20 – 1:256	1:20 – 1:2650	1:20 – 1:40

plant
species

Intermediate results:

- 15 species and mixtures tested
- Effects differ between bacteria
- Some herbs kill bacteria (green)
- Some only inhibit growth (yellow)





green medicines: utopia or option

examples of biodegradable medicines (according to OECD tests)

isosorbide dinitrate	> 90%
mesalazine	> 90%
penicillin V	> 90%
piracetam	> 90%
cytarabine	> 90%
acetylsalicylic acid	81 %
valproic acid	78%
glufosfamide	72%



Prof. Klaus Kümmerer



Stability does not exclude biodegradability.



Biodegradability can be included intentionally.



Biodegradability can improve therapeutic effect and reduce side effects.

Kümmerer K. in Kümmerer K. and M. Hempel (Eds.), 2010, Green and Sustainable Pharmacy, Springer.

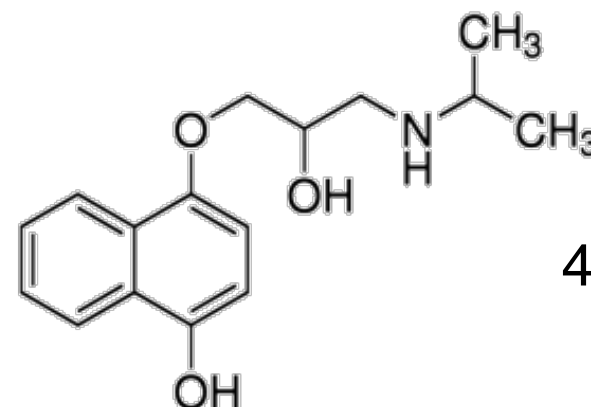
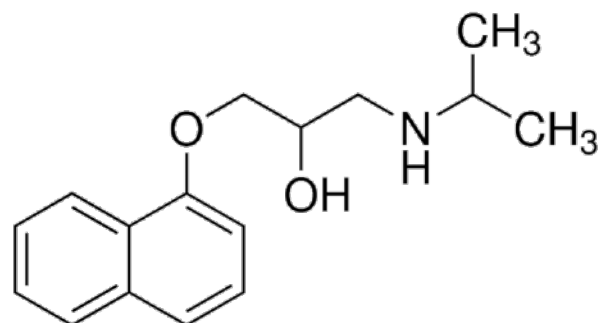


benign-by-design-medicines

not biodegradable

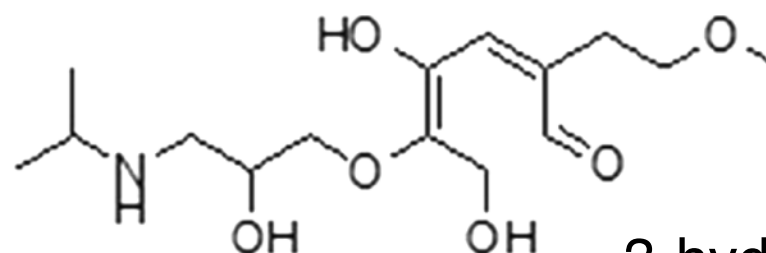
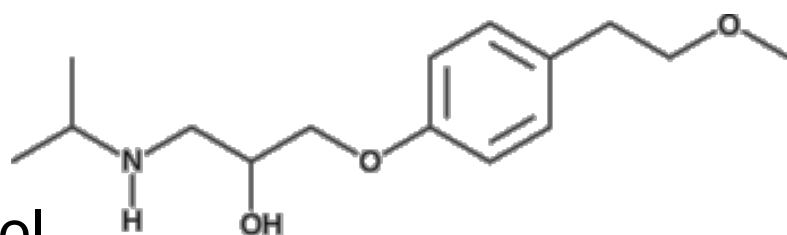
biodegradable

propranolol



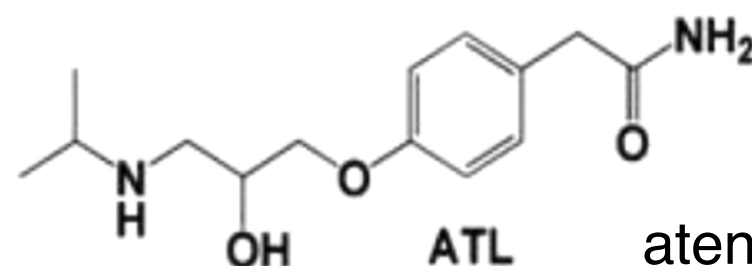
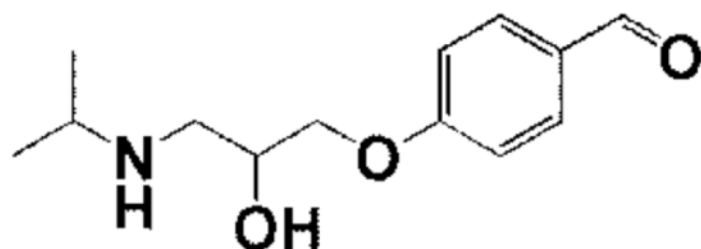
4-hydroxy-propranolol

metoprolol



3-hydroxy-metoprolol

atenolol



ATL

atenolol TP 238

metoprolol: Rastogi T et al. 2014 Chemosphere

propranolol: Rastogi T et al. 2015 Env Sc Techn

atenolol: Rastogi T et al. 2015 RCS Advances



green medicines: phytotherapeutics

International Journal of Neuropsychopharmacology, Page 1 of 11. © CINP 2014
doi:10.1017/S1461145714000017

Lavender oil preparation Silexan is effective in generalized anxiety disorder – a randomized double-blind comparison to placebo and paroxetine



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priorities for action



- Stimulate cross-sectoral pilot projects that work on the whole life cycle of medicines.
- Develop & test source oriented solutions, including prevention.
- Incentives for start-ups and universities for research in biodegradable medicines.



thank you for you attention

More information: [MEDUWA.eu](https://www.meduwa.eu)

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