

Potenzmittel in der aquatischen Umwelt:

- Fakten und Vermutungen

POTENZMITTEL IN DER AQUATISCHEN UMWELT: FAKTEN UND VERMUTUNGEN



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Outline: **Sildenafil**, **Tadalafil**, **Vardenafil**

Facts:

Experimental Approach

SPE (Water & Sludge)

LC-ESI-MS/MS

Monitoring data from Spain & Germany

Biodegradation

Phospho Di-Esterase-V – Inhibitors

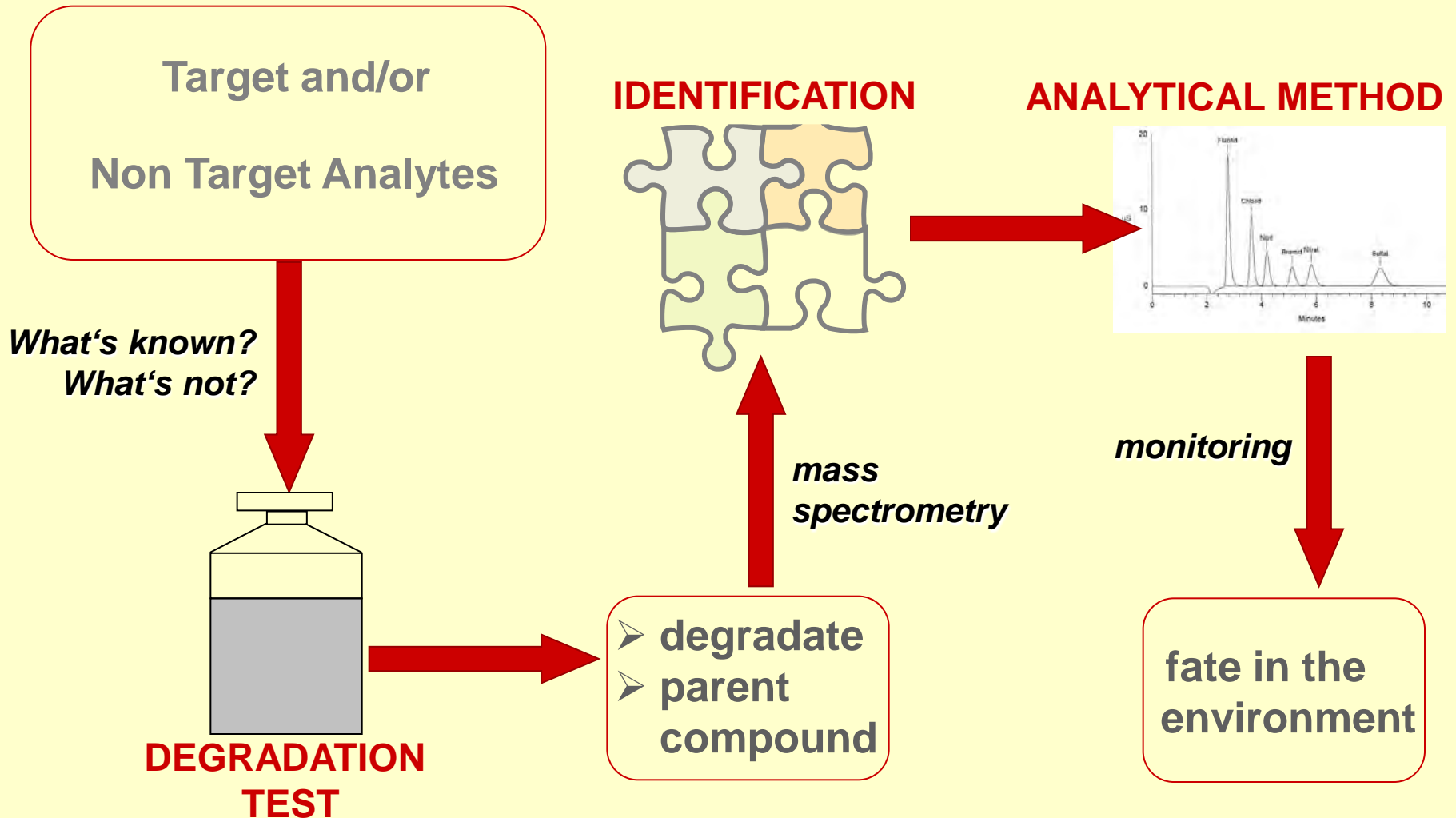
Biochemistry and modes of action

Toxicity

Assumptions

Use & Side effects

Analytical Approach



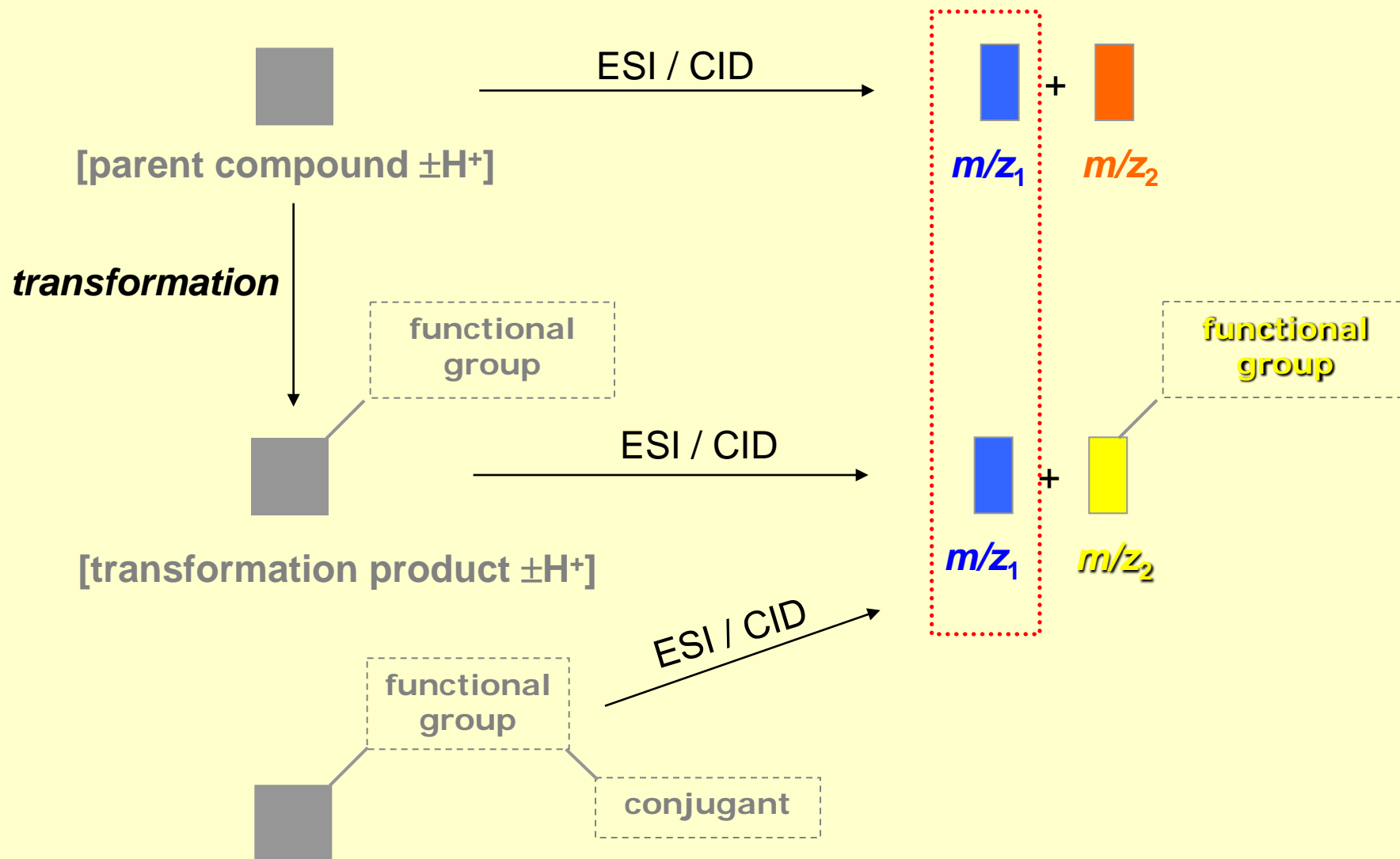
MASS SPECTROMETRY

Structure
Elucidation
(degradate)

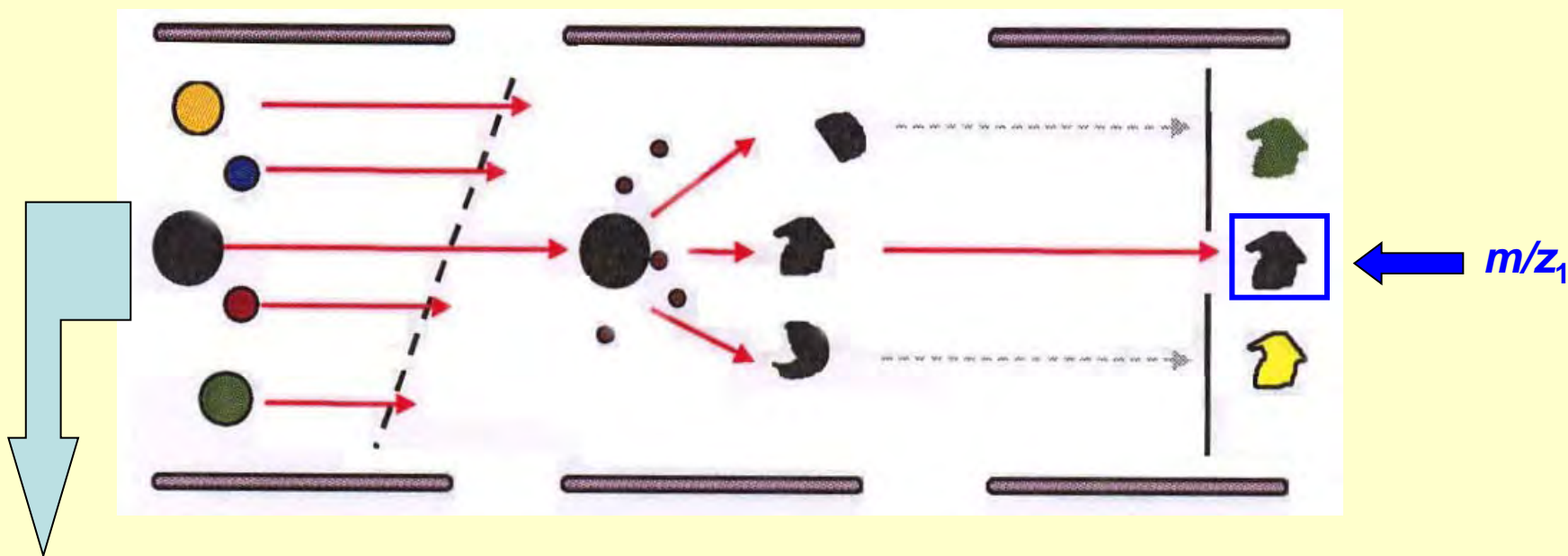
Sensitive
Detection

(parent compound)

Strategy to seek for transformation products



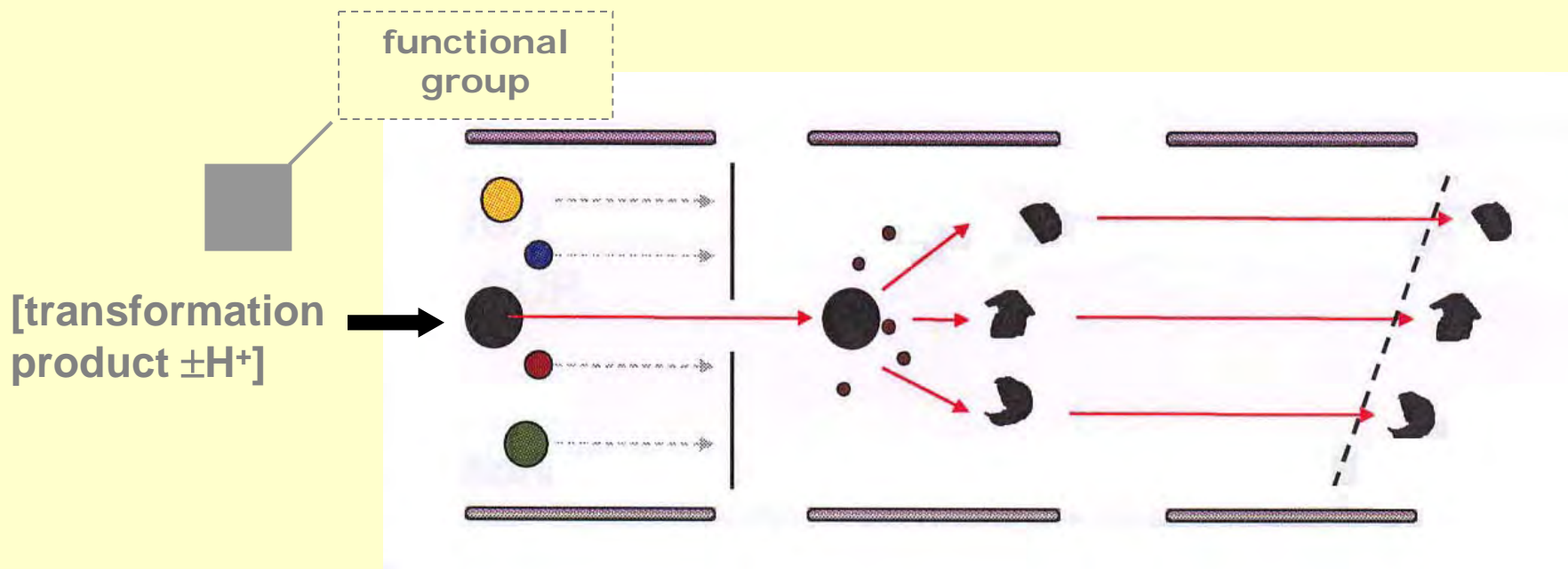
Precursor Ion Scan



Goal: molecular mass of the transformation product

This can be also a neutral loss
Mode: neutral loss (NL)

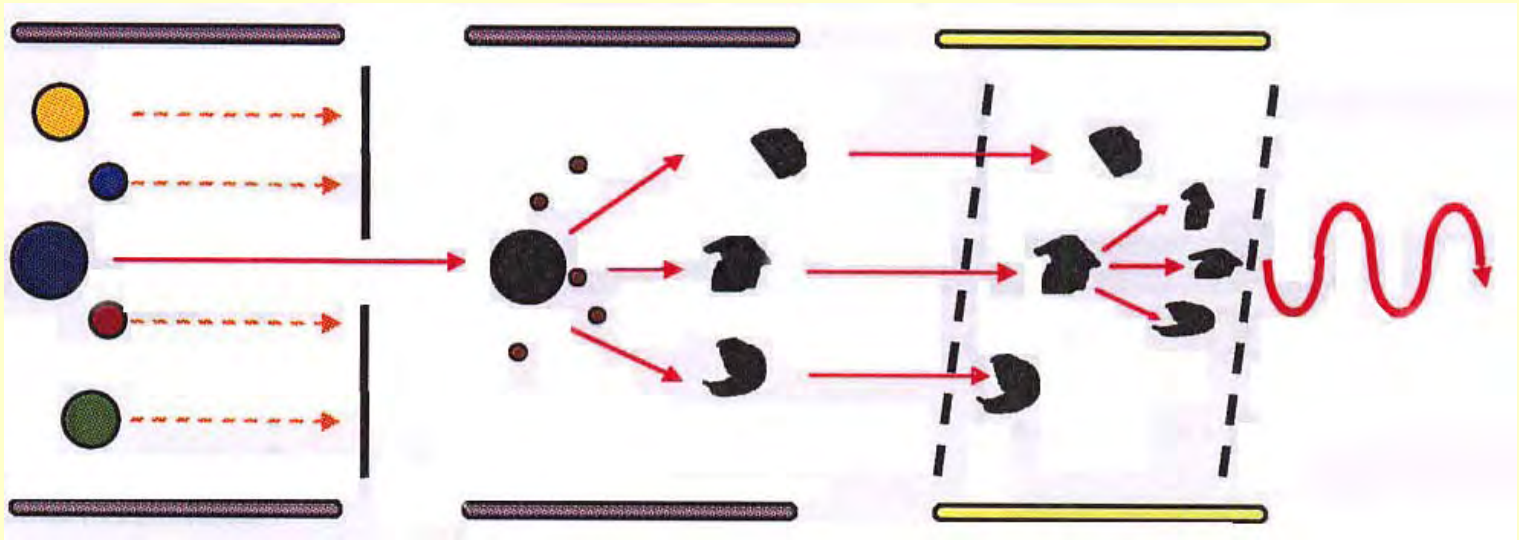
Product Ion Scan



Goal: further structural information

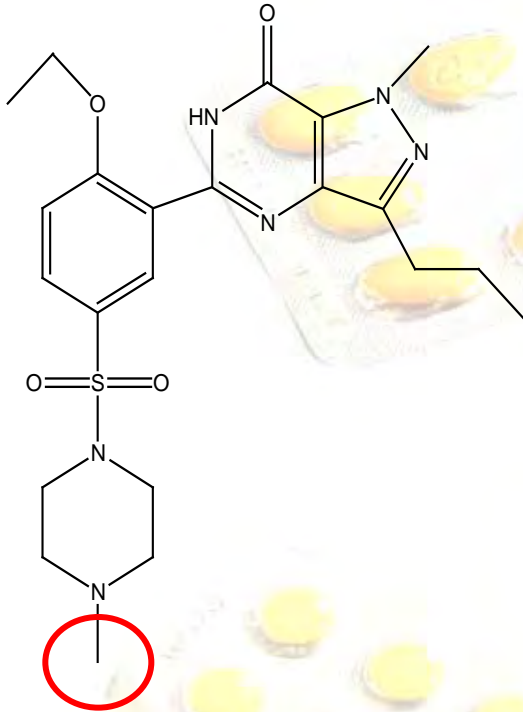
If fragmentation is too strong:
Mode: Time delay fragmentation (TDF)
EPI (Q-LIT)

MS³ (Q-LIT)

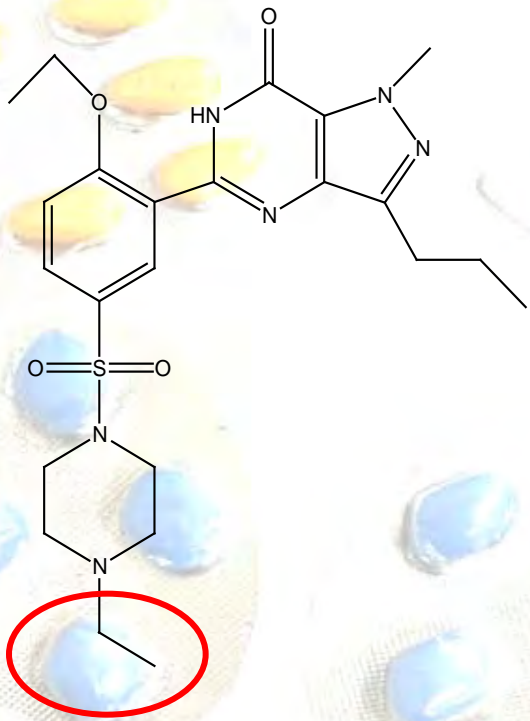


Goal: further structural information

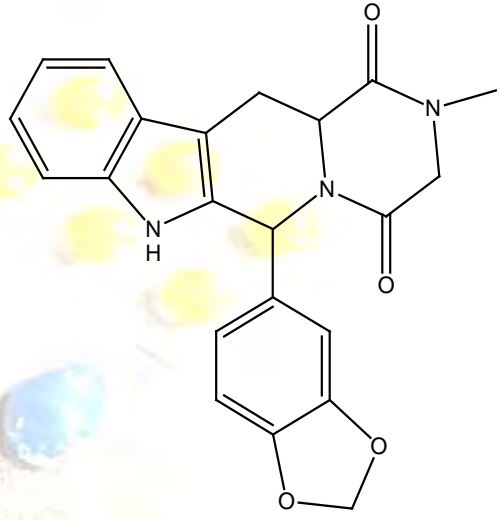
Phosphodiesterase type V (PDE-V)-inhibitors



Sildenafil
Viagra®



Vardenafil
Levitra®



Tadalafil
Cialis®

Hauptzollamt
Frankfurt am Main-Flughafen
Zollamt Fracht
- Arbeitsgebiet IPZ -



POSTANSCHRIFT Hauptzollamt, Frankfurt am Main-Flughafen, Hahnstr. 65-70, 60528 Frankfurt am Main



Cialis®
(Tadalafil Citrate)

ZUM SHOP



LEVITRA®
Vardenafil Citrate

ZUM SHOP



VIAGRA®
Pfizer

ZUM SHOP



Die Pille für die Frau
LOVEGRA*
(Sildenafil Citrate)

ZUM SHOP



KAMAGRA*

ZUM SHOP



Kautabletten



Oral jelly

Arbeitsgebiet IPZ, eine an Sie adressierte Postsendung aus Indien überprüft und dabei

~~16 (sechzehn) Tabletten Tadalafil, Wirkstoff: Tadalafil, a 20mg; 16 (sechzehn) Tabletten Vardenafil, Wirkstoff: Vardenafil, a 20mg; 16 (sechzehn) Tabletten Enacta 100, Wirkstoff: Sildenafil, a 100mg~~

vorgefunden und gemäß § 94 Strafprozessordnung -StPO- sichergestellt.



Each tablet contains
Sildenafil Citrate equivalent to
Sildenafil 100 mg.
Excipients q.s.

Colours : Titanium Dioxide I.P. &
Indigo Carmine Lake.

Dosage :
As directed by the physician.

Storage : Store below 30°C.

Keep away from children.

SCHEDULE H DRUG
Warning : To be sold by retail
on the prescription of a Urologist /
Psychiatrist / Endocrinologist /
Dermatologist / Venereologist only.

Mfg. Lic. No : MNB/05-101

Manufactured by :
Acme Formulation Private Limited,
Roper Road, Nalagarh, Dist. Solan,
Himachal Pradesh - 174 101, India.

MARKETED BY:

RANBAXY

LABORATORIES LIMITED
1204-1215, 12th FLOOR, DEVIKA TOWER,
5, NEHRU PLACE, NEW DELHI - 110 019.

ERIACTA - 100 ERIACTA - 100 ERIACTA - 100

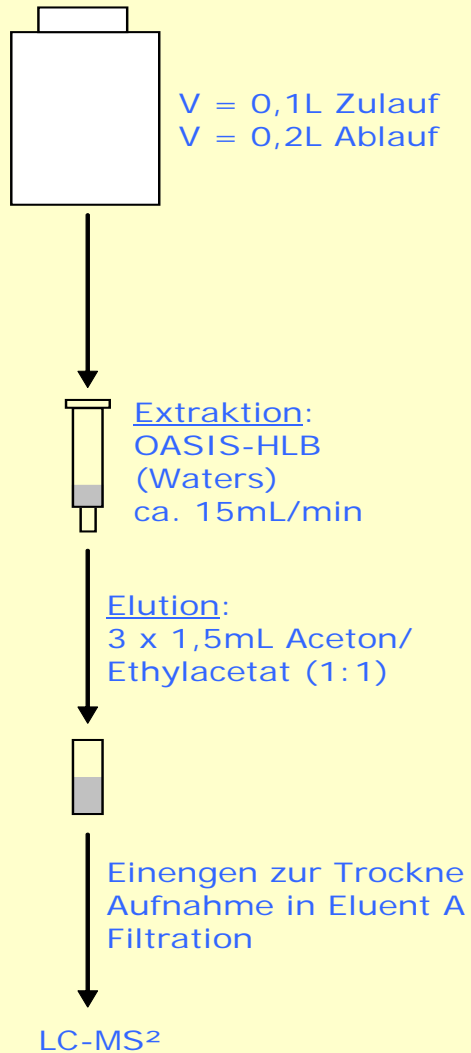
Sildenafil Citrate Tablets

100

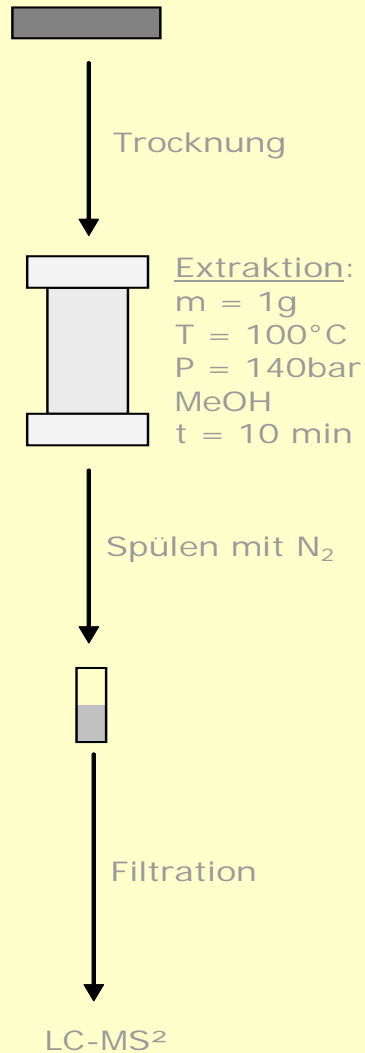
M.R.P. Rs. 1100
PER TABLET
MAY 2008
MAY 2010 (Incl. of GST)

Experimental methodology

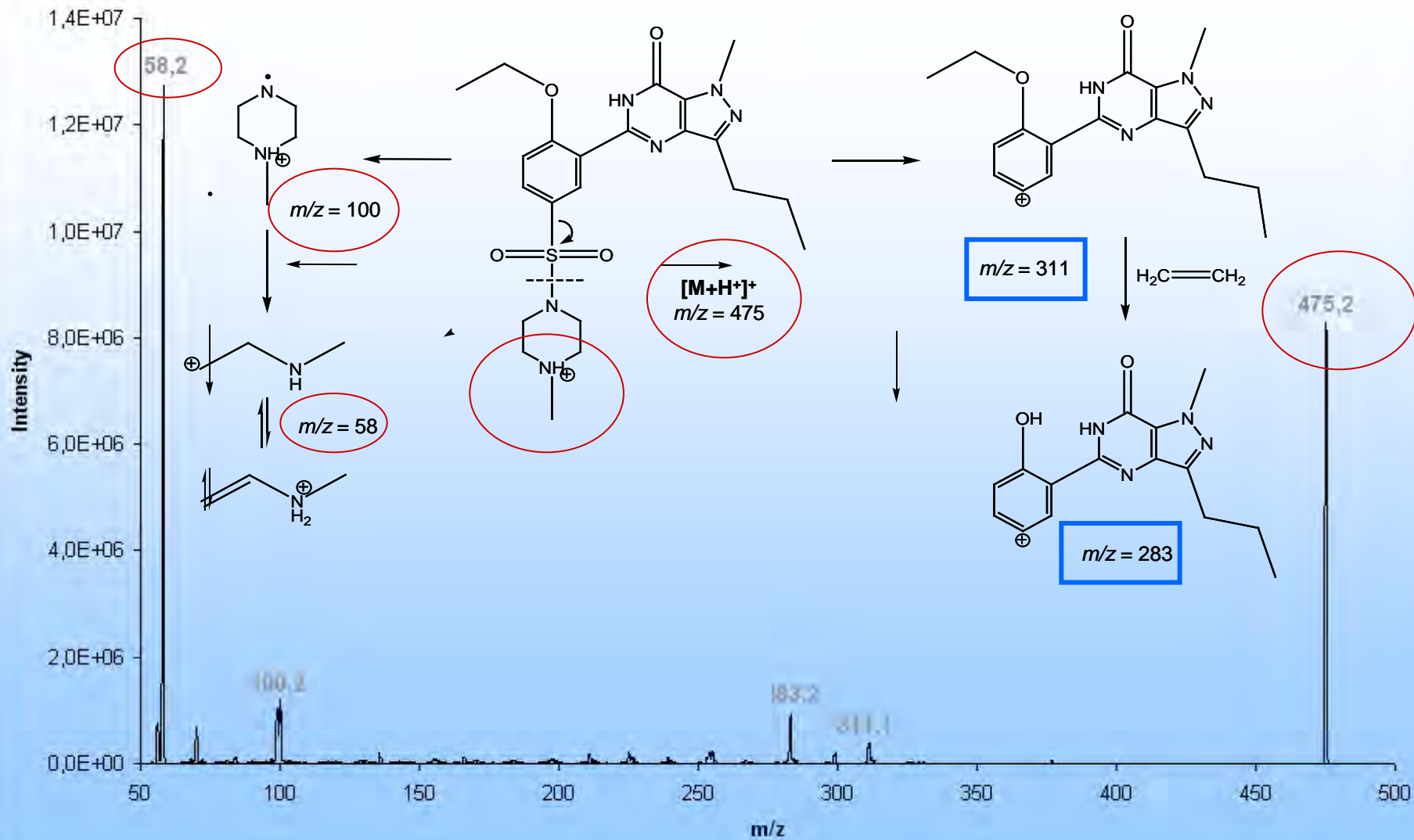
SPE



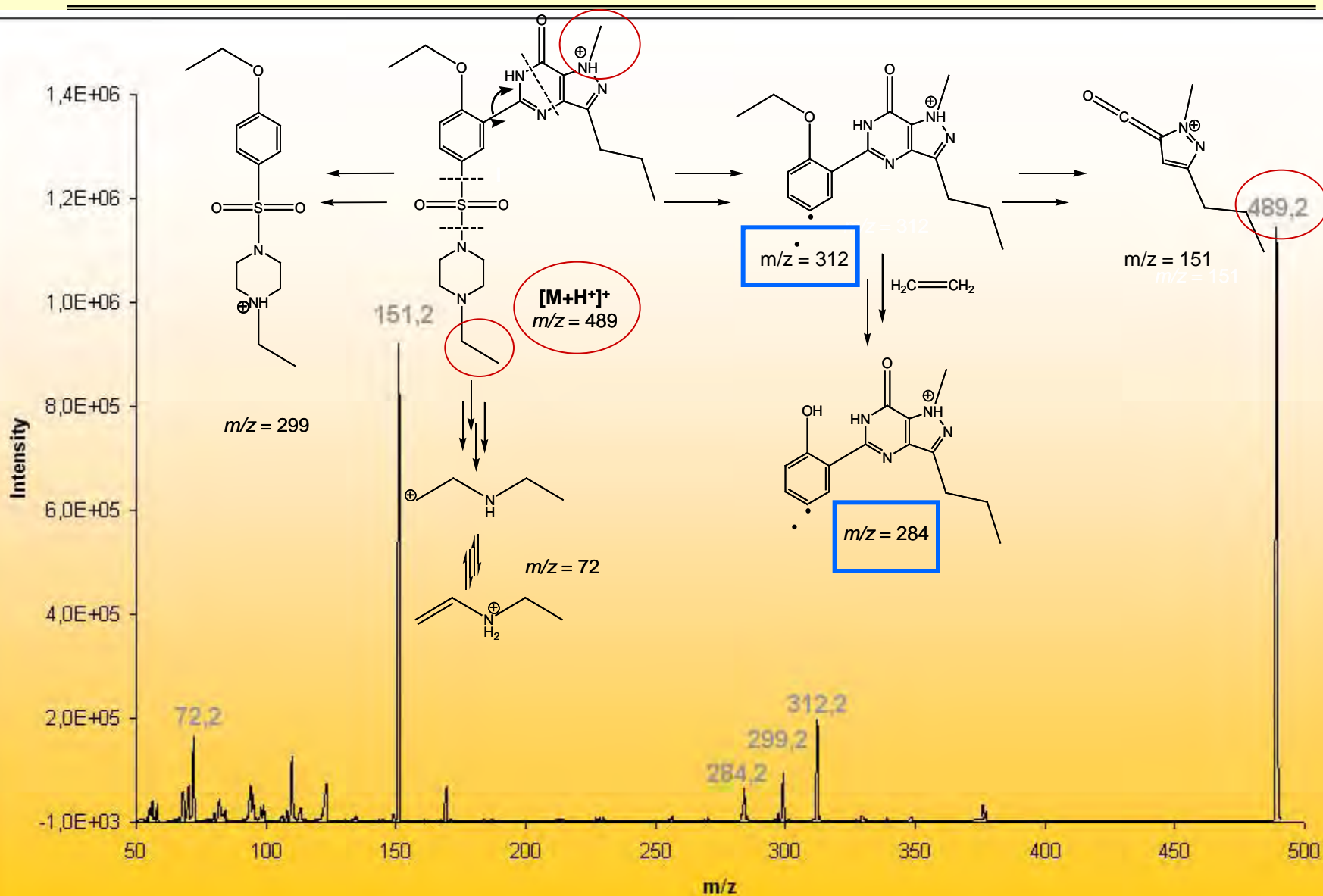
PLE



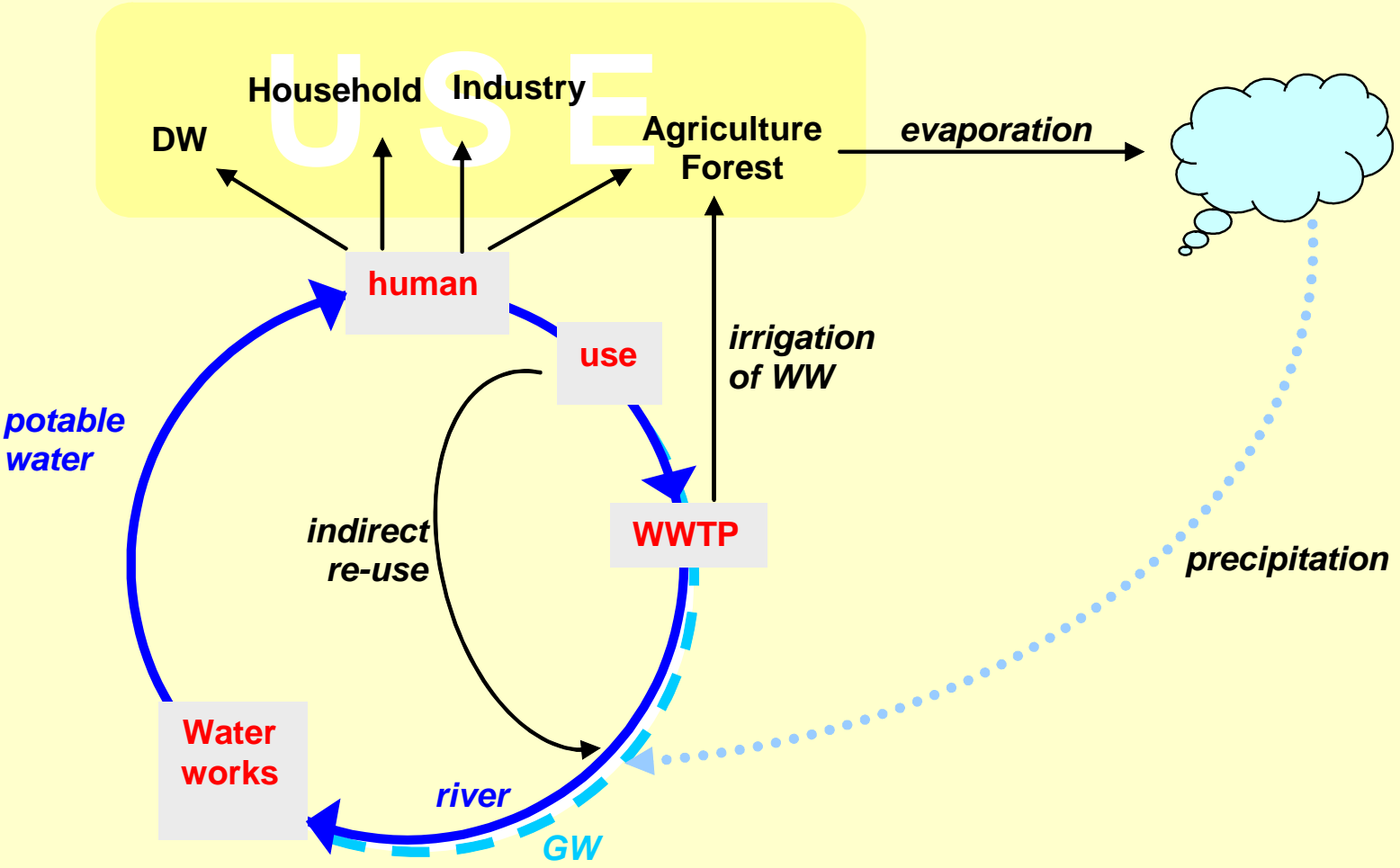
(+) ESI-MS/MS of Sildenafil; Product ion scan $m/z = 475$



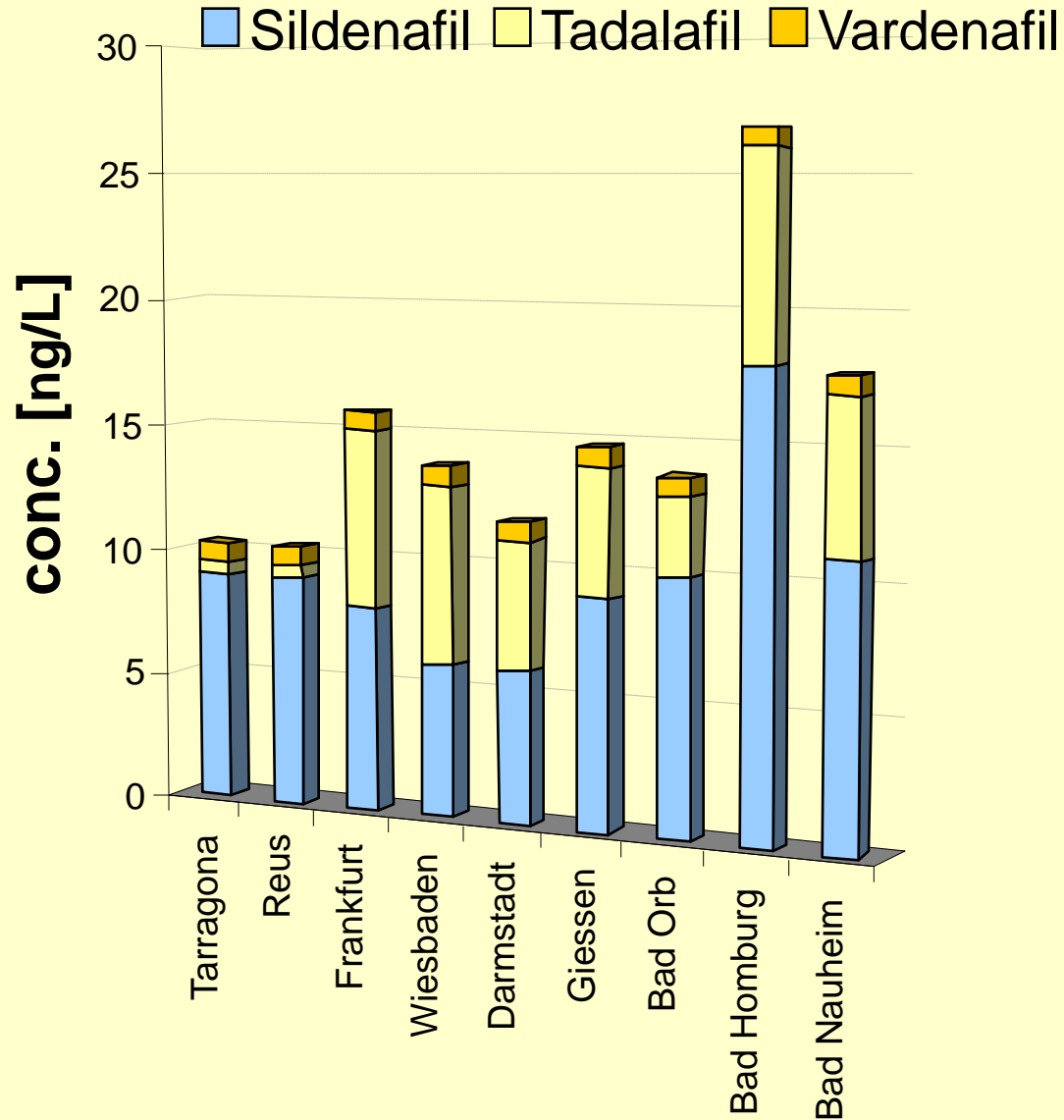
(+) ESI-MS/MS of Vardenafil; Product ion scan $m/z = 489$



Contaminants in the water cycle

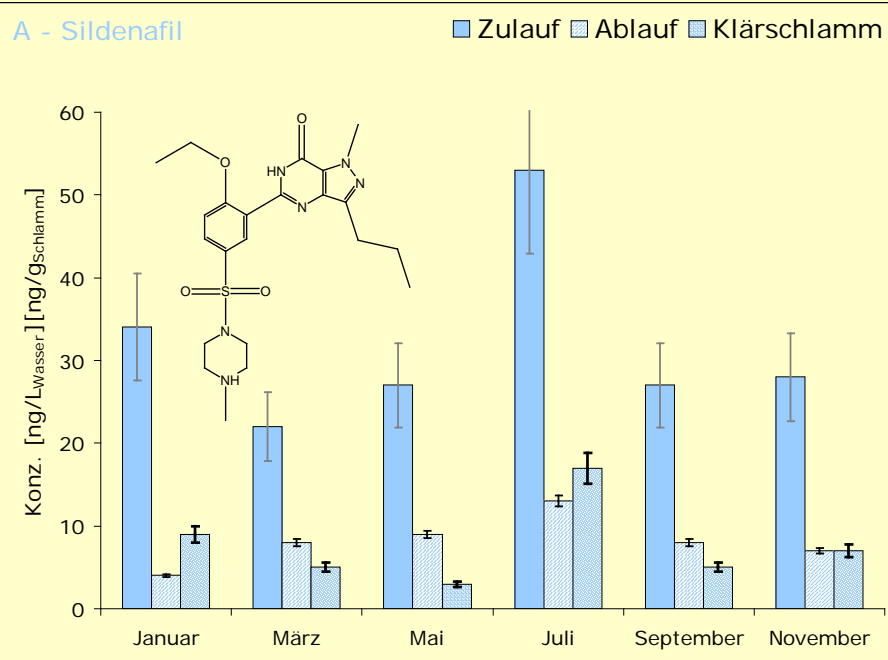


Concentrations of PDE-V-Inhibitors in WW effluents 2008

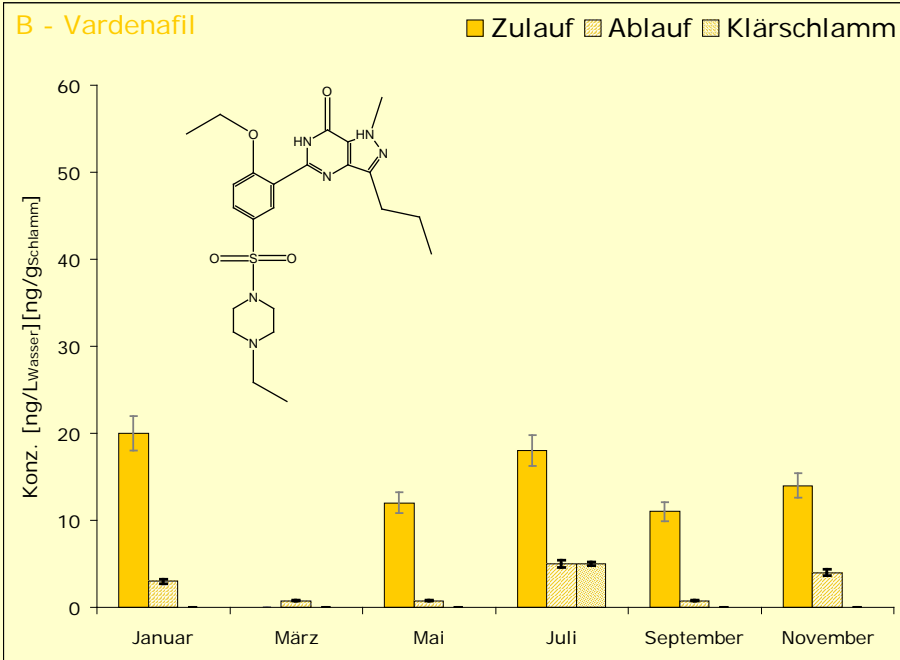


Concentrations of PDE-V-Inhibitors in WW influents, effluents and sludge in WWTP Tarragona, Spain, 2008

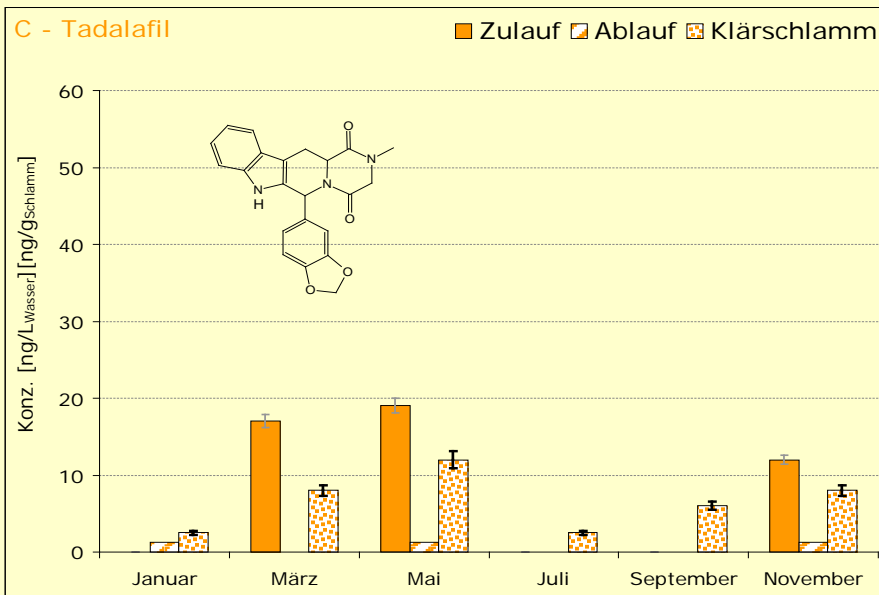
A - Sildenafil



B - Vardenafil

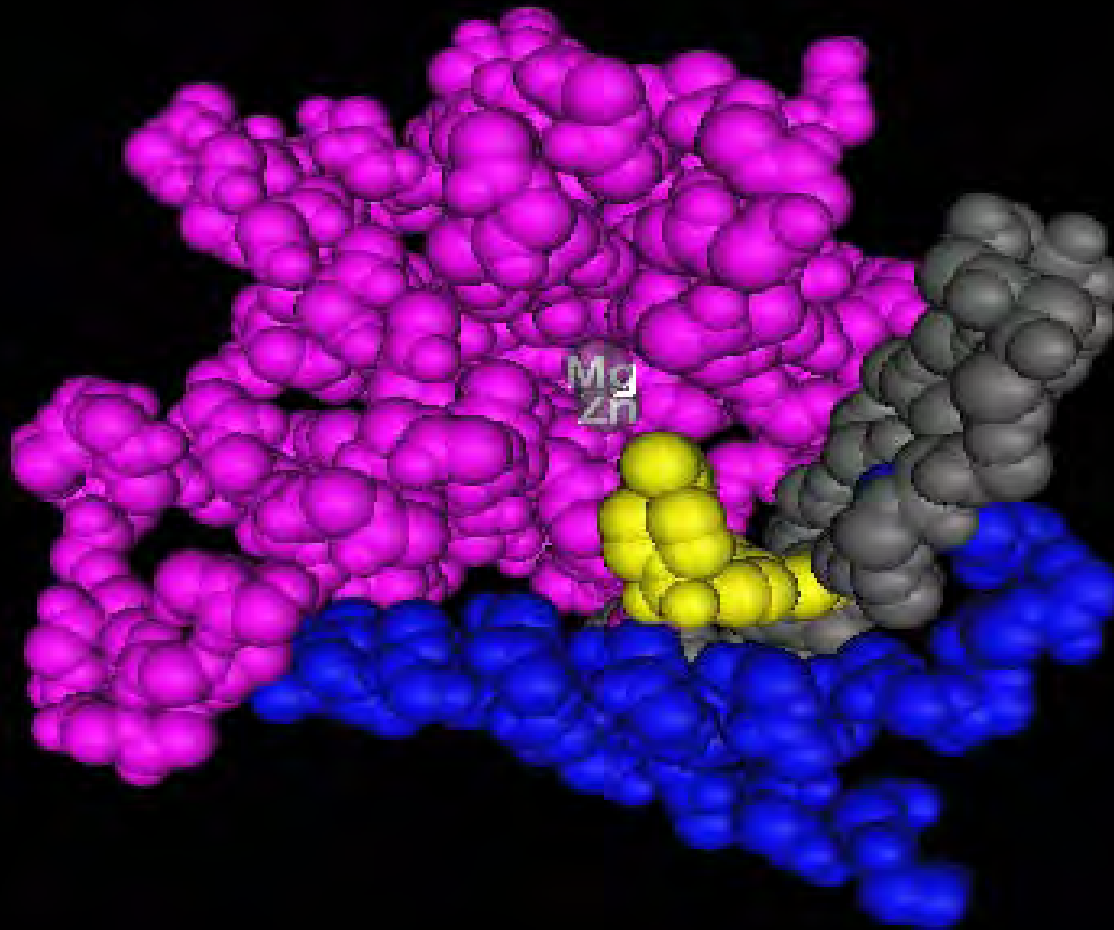


C - Tadalafil



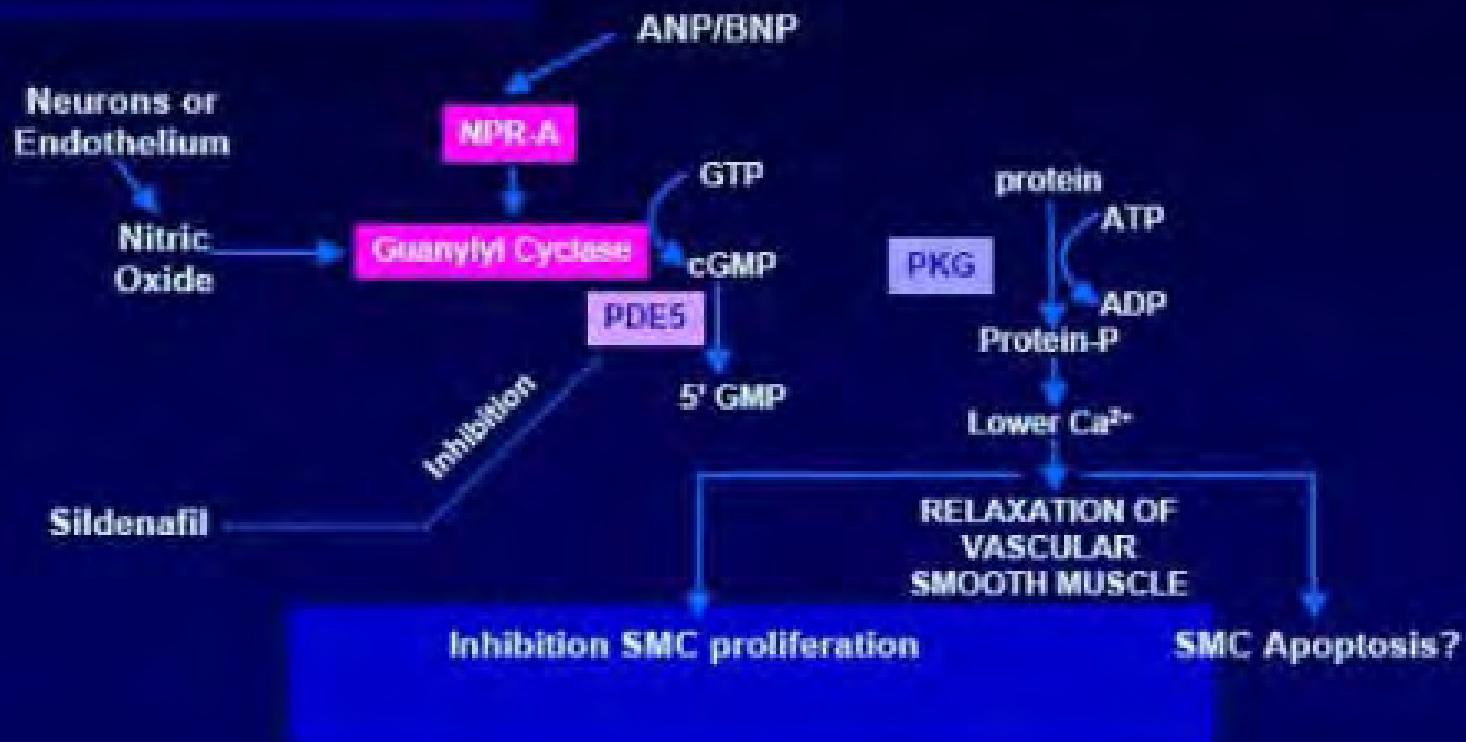
Complex of Vardenafil with PDE-V

(<http://www.ncbi.nlm.nih.gov/Structure/mmdb/mmdbsrv.cgi>)

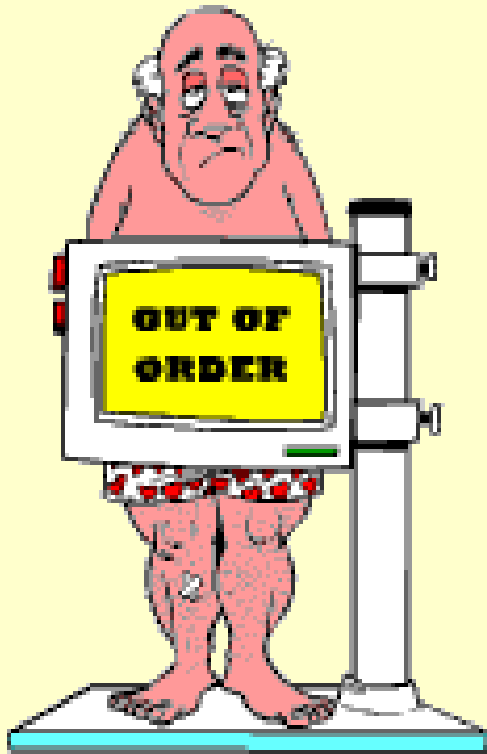


Pharmacology of PDE 5 Inhibitors

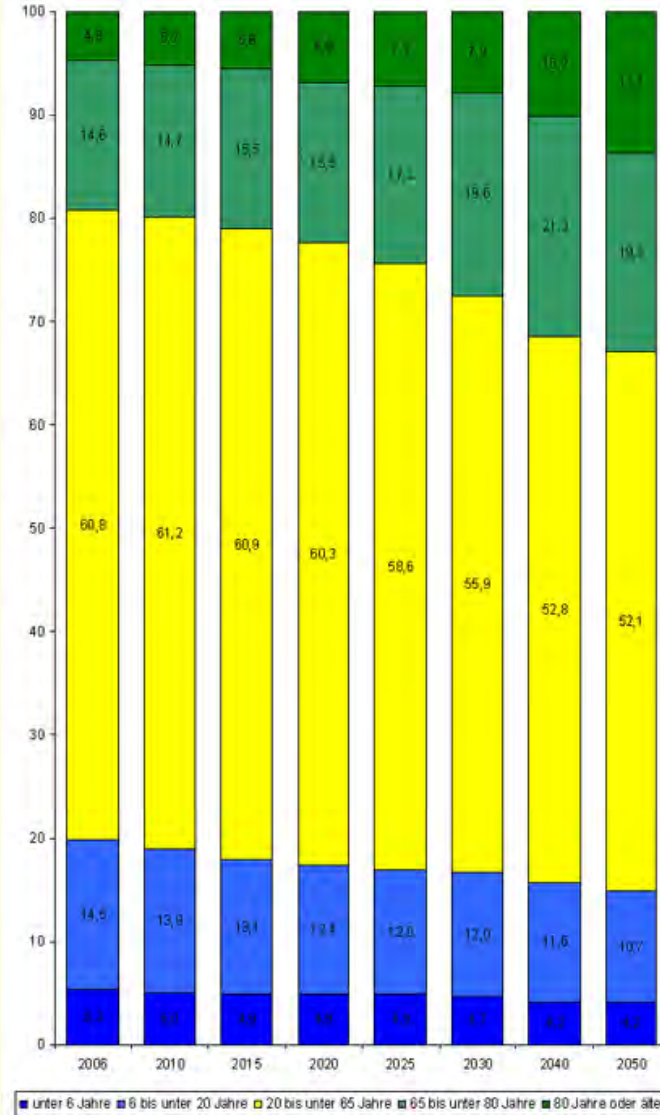
- PDE 5 found abundantly in lung
- Inhibitors increase cGMP and are effective pulmonary vasodilators



Potential use of PDE-V-inhibitors



"Rien ne va plus"



Potenzpille Viagra macht Sportler schneller

Welt Online, R. Dunker ; 26. 11. 2008

Es gilt als sicher, dass Viagra bei manchen Athleten fester Bestandteil eines Dopingcocktails ist. Denn die Pille gegen Potenzstörung verbessert, zumindest in der Höhe, die Sauerstoffaufnahme in der Lunge. Rechtzeitig zu den Olympischen Winterspielen in Vancouver will die Welt-Antidoping-Agentur Viagra auf die Verbotsliste setzen.

New Suspect in Sports Doping Is, No Joke, Viagra

New York Times, 22.11.2008



New Doping control by WADA ?



Estimated ecotoxicological effects

