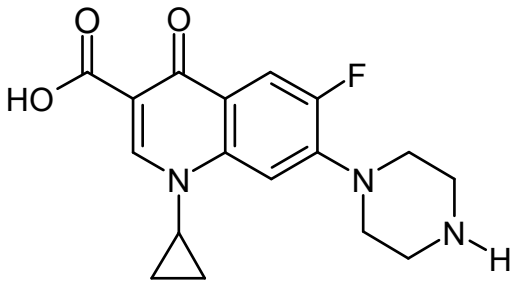
Hands-on exercises to the lecture „Modern Methods in Drug Discovery“ WS24/25

For this tutorial you need Oben Babel preferably in a LINUX environment as we won't make use of the GUI, but rather use command line instructions in a shell/terminal/console.

https://openbabel.org/docs/dev/Installation/install.html

1. From the large class of quinolone antibiotics the most frequently administered one, ciprofloxacin is shown below:



The SMILES of ciprofloxacin and further „floxacines“ are given in the file Floxacines.smi (available for download from the same site as the lecture slides).
This is basically a text file containing SMILES and corresponding compound names.
Copy that file into your working directory.
To perform queries with SMILES/SMARTS we use the command `obgrep` of Open Babel that works similar as the UNIX command `grep`. Here are some examples:

`./obgrep "[N;H1]C(=O)" Floxacines.smi` print all molecules that contain a peptide linkage

`./obgrep -c "C(=O)O" Floxacines.smi` print only the number of matching molecules

`./obgrep -v "C(=O)O" Floxacines.smi` invert matching, print non-matching molecules

See also the SMILES/SMARTS slides of lecture 3 for more examples, patterns, and operators.

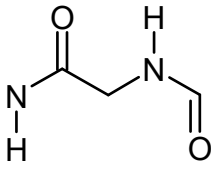
a) Which compounds contain chloride? (search for Cl)

b) Which compounds do not contain fluoride? (use inverted matching for F)

c) How many compounds do not contain any halogens (F, Cl, Br, I)? (use "," as logical OR operator)

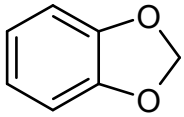
Check your results by having a look at the structures of the compounds that can be found in PubChem (Search for the respective compound name there).

d) Which compound(s) contain a dipeptide linkage? (specify the precise number of hydrogens on the nitrogen atoms)

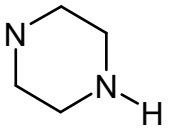


e) Wow many compounds contain a 5-membered ring? (search for ring size of 5)

f) Which compounds contain this fragment ? (specify the left ring as being aromatic)



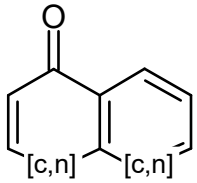
g) Which compounds contain this fragment ? (take care to specifiy the hydrogen atom)



h) What do following SMARTS mean? Draw the corresponding patterns. Look up those floxacines that contain these patterns.

[CX4][NH2]

[OX2;H0][CH3]

[r4]

i) Construct a SMARTS string that matches as many as possible compounds and includes the following fragment (assume that both rings are aromatic, e.g. use lower case lettes for all atoms of the rings):