

Hydrogen Bond (HB)

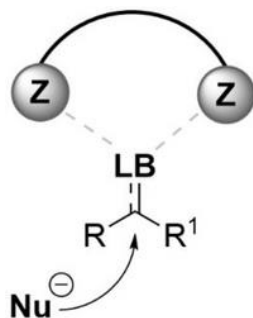
“[...] **attractive interaction** between a hydrogen atom from a molecule or a molecular fragment **X–H in which X is more electronegative than H**, and an atom or a group of atoms [...], in which there is evidence of bond formation.”^[1]

Halogen Bond (XB or HaB)

Chalcogen Bond (ChB)

Pnictogen Bond (PnB)

- Halogen, chalcogen, and pnictogen bonding are sometimes collectively referred to as **sigma-hole interactions**.^[5]
- These types of well-established (halogen, chalcogen) and emerging (pnictogen, tetrel) interactions attracted significant interest in the area of **organocatalysis**.^[6]



Catalysis

- Halogen Bonding (XB)
- Chalcogen Bonding (ChB)
- Pnictogen Bonding (PnB)
- Tetrel Bonding (TB)

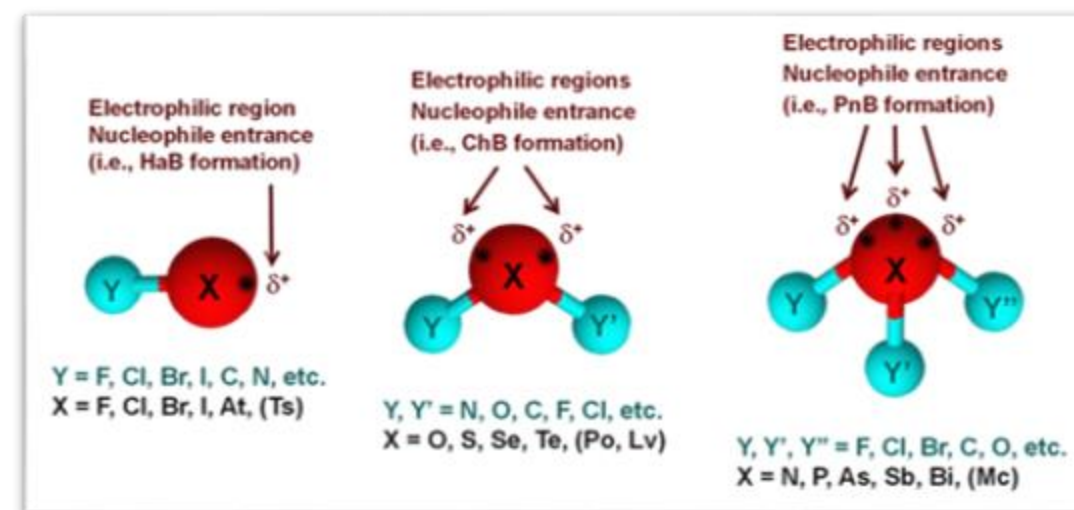
[1] *Pure Appl. Chem.* **2011**, 83, 1637. [2] *Pure Appl. Chem.* **1994**, 66, 1077.

[3] *Pure Appl. Chem.* **2019**, 91, 1889. [4] *Pure Appl. Chem.* **2024**, 96, 135.

[5] *Chem. Sci.* **2024**, 15, 15006. [6] *Angew. Chem. Int. Ed.* **2024**, 63, e202404823 (image reprinted under CC BY-NC-ND 4.0 OA license).

Tetrel Bond (TtB)

Not yet defined by IUPAC ; but best guess: “net **attractive interaction** between an **electrophilic region** associated with a **tetrel** atom in a molecular entity and a nucleophilic region in another, or the same, molecular entity.”



Scheme highlighting electrophilic regions in HaB, ChB, & PnB donors.

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- Ongoing IUPAC project on Ch, Pn, Tt bonds and other interactions of these groups of atoms.^[7]
- Due to carbon in the tetrel group, TtBs will likely face more debate than the other groups.

Get creative with non-covalent interactions!

[7] <https://iupac.org/project/2016-001-2-300/>