BLOCC CHEMISTRY: IMAGINE A WORLD WHERE ANYONE CAN MAKE MOLECULES

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Molecules built primarily from carbon–carbon bonds, or "small molecules," underpin countless aspects of modern life, yet their immense functional potential remains largely untapped. Innovation in this space is constrained by the fact that only a small number of specialists can synthesize such molecules—fewer than can fit in one building worldwide. The difficulty lies in forming carbon–carbon bonds repeatedly and reliably, particularly on automated platforms.

Blocc chemistry offers a transformative solution by enabling iterative carbon–carbon bond formation through the use of MIDA and TIDA ligands, which reversibly attenuate boronic acid reactivity. This discovery allows small molecule synthesis to be performed in a way that is compatible with robots, AI, and non-specialists. A further breakthrough—that MIDA/TIDA boronates display binary elution behavior on silica—established a universal, automation-friendly purification strategy.

Now adopted globally, blocc chemistry has enabled over 1,000 publications and 300 patents spanning natural products, pharmaceuticals, agrochemicals, and materials. In the Burke lab, it has yielded molecular prosthetics for cystic fibrosis and other diseases, and renal-sparing antifungal agents now in clinical trials. Integration with AI and automated functional testing is advancing closed-loop discovery, while the Molecule Maker Lab is translating this approach into a democratized platform for molecular innovation.