curvature is odd in energy (20), \( \sigma_{xy} \) has the same sign for both electrons and holes. This contrasts with the conventional Hall conductivity that is sign-changing under carrier-type reversal. As a result, \( \sigma_{xy} \) given by Eq. 2 is less susceptible to smear- ing by inhomogeneity. This mechanism yields a nonzero \( R_{\text{NL}} \), whenever the Fermi level is tuned through Berry curvature hot spots. Their extent in energy is given by half the bandgap \( \Delta \) at 190 K, which translates into \( n \approx 2 \times 10^{19} \text{cm}^{-2} \) and agrees well with the ultranarrow width of our \( R_{\text{NL}} \) peaks.

Because of TRS, the electric field generates topological currents (Eq. 1) with opposite transverse components in graphene's two valleys, \( K \) and \( K' \) (Fig. 1A), to create the charge-neutral VHE, \( J_{z} = J_{k} - J_{k}' = \sigma_{xp}E \), where \( \sigma_{xp} = 2\sigma_{xy} \). As illustrated in the inset to Fig. 1B, topological currents can result in a VHE conductivity of \( \approx 2e^{2}/h \). In the absence of intervalley scattering, the charge-neutral currents can persist over extended distances and mediate nonglobal electrical signals (24–28). The resulting nonglobal resistance \( R_{\text{NL}} \) can be understood as originating from the VHE and a reverse VHE (20), by analogy with nonglobal transport mediated by charge-neutral spin or energy flow (24–28). Yet unlike the latter, the VHE-induced nonglobality appears without TRS breaking—that is, at zero \( B \). This behavior, as well as the narrow range of \( n \) over which \( R_{\text{NL}} \) is observed, is a telltale sign of bulk topological currents. The analysis outlined above yields the model expression (20)

\[
R_{\text{NL}} = \frac{w}{2e^{2}}\left(\sigma_{xy}\right)^{2}\rho_{xx}\exp(-L/\xi)
\]

The peak in \( R_{\text{NL}}(n) \) can be described by Eq. 3 with no fitting parameters (Fig. 2B).

The measured spatial decay with \( \xi \approx 1.0 \mu \text{m} \) is consistent with intervalley scattering occurring at graphene edges and/or at atomic-scale defects (20). The large values of \( R_{\text{NL}} \) at \( L = 1 \mu \text{m} \) are due to several micrometers also imply extremely strong topological currents locally, within the path of the applied current. By extrapolating the observed \( L \) dependence to \( L < 1 \mu \text{m} \), Fig. 2C yields \( R_{\text{NL}} \) ~10 kilohm. According to Eq. 3, this translates into \( \sigma_{xy} \approx 2e^{2}/h \) and order-one Hall angles, which is in agreement with the VHE expected for weak intervalley scattering. Furthermore, similar to classical magnetotransport, changes in the direction of current flow can lead to additional resistivity. For \( \rho_{\alpha\beta} = \rho_{\text{xx}} \), the classical magnetoresistance reaches a value of \( \rho_{\text{xx}} \) when carriers of opposite sign are involved. A valley analog of this extra resistance may explain anomalous contributions of ~10 kilohm in \( \rho_{\text{xx}} \), which are observed at short distances \( L = w \) by using the bend geometry (Fig. S7). Parenthetically, the intrinsic VHE mechanism discussed above, which provides excellent agreement with our experimental results, may coexist with extrinsic VHE mechanisms such as skew scattering and side jumps (6). Although their role in graphene superlattices remains to be examined, such mechanisms also originate from Berry curvature and are subject to the same symmetry conditions as the intrinsic contribution.

Last, sharp changes in \( R_{\text{NL}} \) with \( V_{z} \) (30-nm-thick dielectric) (Figs. 1 and 2) amount to a transistor-like response with a slope of \( \approx 100 \text{mV/dec} \)—that is, the detected voltage changes by a factor of 10 by varying \( V_{z} \) by \( >100 \text{mV} \). Although the peaks in \( R_{\text{NL}} \) broaden with increasing \( T \) and \( D \), which is in agreement with the VHE expected for weak intervalley scattering. Furthermore, which is in agreement with the VHE expected for weak intervalley scattering. Furthermore, which is in agreement with the VHE expected for weak intervalley scattering. Furthermore, which is in agreement with the VHE expected for weak intervalley scattering.

\[
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Wide range of \( C-H \) activation reactions have emerged as promising tools for organic synthesis over the past two decades. However, the development of enantioselective \( C-H \) activation reactions has met with limited success in terms of efficiency and scope (7). Enantioselective carbene insertions into prochiral methylene \( C-H \) bonds adjacent to heteroatoms have been achieved in synthetically useful enantioselectivity (2). Asymmetric nitrene insertion has also been demonstrated in both diastereo and enantioselective
manner (3–6). Development of asymmetric C–H activation reactions involving a metal insertion step has also witnessed limited but encouraging progress. Combining C–H activation with subsequent asymmetric carbometalation onto double bonds elegantly connects C–H functionalization reactions to asymmetric catalysis (7, 8). An early example of atroposelective alkylation in moderate enantioselectivity (49% enantiomeric excess (ee)) was reported (9). Recently, Pd-catalyzed desymmetrization of prochiral C–H bonds has been achieved with excellent levels of enantioselectivity (30–14) (Fig. 1A). However, the requirement for the presence of two chemically identical groups necessarily limits the structural diversity of the chiral products, preventing the broad application of this method in asymmetric synthesis. An effort to overcome this limitation by developing enantioselective C–H activation of racemic mixtures via a regiodivergent pathway has been reported with an intramolecular reaction (15).

Chiral amines are one of the most prevalent motifs in bioactive natural products, drug compounds, and chiral catalysts. Despite remarkable progress in the development of catalytic enantioselective methods for synthesis of chiral amines (16), chiral auxiliaries (17), classical resolution by crystallization of chiral salts, and enzymatic kinetic resolution (18, 19) are more often used in practice. Nonenzymatic kinetic resolution of amines by asymmetric acyl transfer catalysts remains a substantial challenge when compared to the analogous kinetic resolution of alcohols (20–22).

In our efforts to develop alternative methods for the asymmetric synthesis of chiral amines, we recently achieved the enantioselective C–H iodination of triflyl-protected benzylamines by desymmetrization (11). This ligand-controlled reaction has recently been modified to achieve an atroposelective C–H iodination through kinetic resolution in promising selectivity (s ≤ 27) (23). To access a wide range of chiral α-branched benzylamines that do not contain two identical aryl groups, we embarked on the development of a kinetic resolution process through an enantioselective C–H iodination of arylalkylamines. Practically, this type of process would not only lead to the resolution of racemic amines but also concurrently introduce a new functional handle for the further elaboration of the product. Conceptually, the chiral recognition required in kinetic resolution is fundamentally different from that in the desymmetrization process. The catalyst must preferentially recognize one of the enantiomeric substrates in kinetic resolution rather than one of the prochiral groups within the same substrate as in desymmetrization. We were inspired in this context by the landmark success in kinetic resolution of Jacobsen’s cobalt-salen–catalyzed epoxide opening process (24). The Pd(II)-catalyzed asymmetric oxidation of racemic alcohols (25, 26) has also been demonstrated. However, kinetic

*Corresponding author. E-mail: yu200@scripps.edu

The Scripps Research Institute, 10550 North Torrey Pines Road, La Jolla, CA 92037, USA.
resolution via a Pd-catalyzed C–H activation reaction involving chiral C(sp3) centers remains to be established.

Here, we report the discovery of a highly efficient kinetic resolution of chiral amines by Pd-catalyzed C–H iodination with selectivities reaching up to 244 (Fig. 1B). In addition to simple arylalkylamines, a wide range of β-amino acids and β-amine alcohols are compatible with this reaction. The use of ambient temperature provides a major operational advantage over nonenzymatic acylative kinetic resolution reactions, which often require low temperature conditions. We further demonstrate that the remaining starting material can subsequently be iodinated using a chiral ligand with opposite configuration to give ortho-iodinated chiral benzylamines. The newly introduced ortho-iodides are capable of converting both enantiomers of the racemic amines into ortho-iodinated chiral benzylamines. The newly introduced ortho-iodides are a useful functional handle, allowing conversion of the products into a broad range of chiral amines.

Our experimental design was based on a previous finding that a mono-protected amino acid ligand (MPAA) can effectively control the stereochemistry in Pd-catalyzed asymmetric insertion into prochiral C–H bonds on different carbon centers, leading to desymmetrization (10). This led us to hypothesize that the chiral catalyst assembled from the amino acid ligand and Pd(II) species could preferentially recognize one enantiomer of a racemic substrate during the C–H activation step. If successful, a wide range of C–H activation reactions could potentially be developed into practical tools for asymmetric catalysis through kinetic resolution. Due to its compatibility with low reaction temperatures, we selected our recently developed C–H iodination as a model reaction to investigate the feasibility of achieving kinetic resolution of α-branched benzylamines at room temperature. Thus, 1-(α-tolyl) ethylamine, protected by a triflyl group (1a), was subjected to our iodination conditions in the presence of various mono-protected amino acid ligands (see table S1). We found that using benzoyl-protected L-2-aminopentanoic acid (norvaline) as the chiral ligand, Pd(II)-catalyzed iodination of 1a proceeded with promising selectivity (table SI, entry 1, s = 17.6). A minor increase in steric hindrance on the side chain when leucine was used improved the selectivity to 50 (table S1, entries 2 and 3). However, further tuning the steric bulkiness of the side chain only afforded lower selectivity (table S1, entries 4 to 6). Extensive efforts to improve the selectivity by using a substituted N-benzyl protecting group were unsuccessful (table S1, entries 7 to 12). We also found that acetyl, trifluoroacetyl, and Boc protecting groups were inferior to benzoyl-type protecting groups (table S1, entries 13 to 15). We further found that an increase in the reaction concentration improved the selectivity to 62.0 (table S1, entry 16). Finally, an optimal selectivity of 78.8 was obtained by running the reaction in a 5:2.2 ratio of β-amyI alcohol and dimethyl sulfoxide (table S1, entry 17). In this case, both the iodinated product and the recovered starting material were obtained with high enantioselectivity (92% ee) at 50% conversion. The reaction also proceeded with 2 mole percent Pd catalyst to reach a selectivity of 51.2, albeit at longer reaction times (table S1, entry 17). Reducing the ratio of ligand/Pd from 4:1 to 2:1 in the iodination of 1a resulted in a significant drop of selectivity (s = 33), which can be attributed to competitive binding of the substrate versus ligands (table S1, entry 18).

To examine whether this method could be applied to prepare a broad range of chiral ortho-iodinated benzylamines, we subjected amines 1b to 1l to the optimized conditions (Table 1). Iodination of benzylamines 1a to 1c gave good to excellent selectivity, whereas the bulkier α-isobutyl and benzyl groups in 1d and 1e led to decreases in the selectivity factor to 25.0 and 13.8, respectively (Table 1, entries 1 to 5). Iodination of benzylamine 1f containing a cyclopropyl group proceeded with an excellent selectivity factor (entry 6, s = 83.5). Arenes containing ortho-methoxy and fluoro groups were also iodinated with outstanding selectivity (entries 7 and 8, s = 148 and 240, respectively). The presence of a para-chloro group on the aryl fragment in 1i was well tolerated (entry 9, s = 113). Meta- and para-methyl substituted arenes 1j and 1k were more suitable substrates than the ortho-methylarene 1a affording excellent selectivity (entries 10 and 11, s = 99.5 and 91.7, respectively). Iodination of 1l containing 2-naphthyl group also proceeded with synthetically useful selectivity (entry 12, s = 76). In general, the iodinated products were obtained with high levels of enantioselectivity (91 to 97% ee), with the exception of entries 3 to 5. To investigate whether the decrease of enantioselectivity with these substrates containing bulkier α-alkyls (entries 3 to 5) was a general phenomenon, we subjected 1m containing α-butyl to the standard iodination conditions. The reaction proceeded with high selectivity (entry 13, s = 124), thus suggesting that the observed adverse effect of the bulky α-alkyl group was partially due to the ortho-methyl groups in substrates 1a to 1e. However, the presence of an even bulkier α-iod-propyl in substrate 1n also reduced the selectivity to 34.5 (entry 14). Replacing the α-iod-propyl with α-t-butyl resulted in a loss of reactivity under current conditions.

Table 2. Enantioselective C–H iodination of β-amino acids and amino alcohols.

<table>
<thead>
<tr>
<th>entry</th>
<th>Ar</th>
<th>time (h)</th>
<th>conv. (yield, %)</th>
<th>ee(%)²</th>
<th>s³</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ph</td>
<td>48</td>
<td>47 (44, mono:di=2:1)</td>
<td>86</td>
<td>96⁵ 128</td>
</tr>
<tr>
<td>2</td>
<td>2-MePh</td>
<td>24</td>
<td>49 (49)</td>
<td>93</td>
<td>96 168</td>
</tr>
<tr>
<td>3</td>
<td>3-MePh</td>
<td>48</td>
<td>50 (44)</td>
<td>93</td>
<td>94 112</td>
</tr>
<tr>
<td>4</td>
<td>4-MePh</td>
<td>48</td>
<td>46 (43, mono:di=3:1)</td>
<td>82</td>
<td>98⁵ 134</td>
</tr>
<tr>
<td>5</td>
<td>4-FPh</td>
<td>48</td>
<td>48 (41)</td>
<td>90</td>
<td>98 244</td>
</tr>
<tr>
<td>6</td>
<td>4-ClPh</td>
<td>48</td>
<td>49 (40)</td>
<td>92</td>
<td>97 152</td>
</tr>
<tr>
<td>7</td>
<td>4-CF₃Ph</td>
<td>48</td>
<td>40 (38)</td>
<td>65</td>
<td>99 155</td>
</tr>
</tbody>
</table>

*Calculated conversion, c = eeS / (eeS + eeR). ²Isolated yield of the iodinated product. ³Determined by chiral HPLC analysis. ⁴Selectivity(s) = (rate of fast-reacting enantiomer) / (rate of slow-reacting enantiomer). ⁵Determined by crude ¹H-NMR. ⁶ee for the mono product. ⁷equiv. Iₐ was added after 24 h.

<table>
<thead>
<tr>
<th>entry</th>
<th>Ar</th>
<th>time (h)</th>
<th>conv. (yield, %)</th>
<th>ee(%)²</th>
<th>s³</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ph</td>
<td>48</td>
<td>43 (40, mono:di=1:1)</td>
<td>71</td>
<td>87⁵ 99¹ 88.0</td>
</tr>
<tr>
<td>2</td>
<td>2-MePh</td>
<td>48</td>
<td>50 (49)</td>
<td>91</td>
<td>92 77.2</td>
</tr>
<tr>
<td>3</td>
<td>2-FPh</td>
<td>48</td>
<td>41 (41)</td>
<td>68</td>
<td>99 188</td>
</tr>
<tr>
<td>4</td>
<td>2-naphthyl</td>
<td>48</td>
<td>43 (40)</td>
<td>72</td>
<td>96 112</td>
</tr>
</tbody>
</table>

*Determined by crude ¹H-NMR. ⁶ee for the mono product. ⁷ee for the di product.
We next investigated whether our enantioselective iodination could be applied to the production of iodinated chiral β-amino acids (Table 2A). In spite of a number of highly creative asymmetric methods for making enantioenriched β-amino acids (27), resolution is still frequently used in practice because of the ease of preparing racemic β-amino acids by the Rodionov reaction. The development of highly efficient catalysts to resolve racemic β-amino acids continues to attract considerable attention. Using our methodology, β-phenyl-β-amino acid 4a was iodinated under the standard conditions to give 6a with excellent selectivity (s = 128). Substrates containing electron-donating groups at the ortho, meta and para positions of the β-phenyl groups were all iodinated with high selectivity factors ranging from 112 to 168 (Table 2A, entries 2 to 4). Electron-withdrawing groups on the β-phenyl rings were also compatible with this transformation affording selectivity factors as high as 244 (entries 5 to 7). In all cases, the iodinated amino acid derivatives were obtained with high levels of enantiom selectivity (94 to 99% ee).

We were pleased to find that this enantioselective C–H activation method was also suitable for preparing ortho-iodinated chiral β-amino alcohols (Table 2B). 2-Phenyl amino alcohol 7a was iodinated with a practically useful selectivity (s = 88). The ortho-methyl group in 7b led to a slight decrease in the selectivity factor (s = 77.2), whereas 2-(ortho-fluoro)-phenyl and 2-naphthylamino alcohols were iodinated with excellent selectivity (s = 188 and 112, respectively).

To further demonstrate the versatility of this kinetic resolution process, we developed a protocol to convert both enantiomers of the racemic amine substrates to the chiral-iodinated amines in high enantiomeric purity. Thus, 1.0 g of 11 was subjected to the standard reaction conditions using the β-amino acid ligand to give 37% iodinated product 3l (maximum 50% yield) with 95% ee (Fig. 2A). The absolute configuration of 3l determined by x-ray crystallography should also facilitate future establishment of a stereomodel for kinetic resolution by C–H activation. The recovered starting material 2l with 69% ee was then iodinated using the β-amino acid ligand to give chiral amine 3i in 98% ee (Fig. 2A). The use of ligands possessing the opposite configuration to enantioselectively iodinate the enantiomerically enriched starting material could prove extremely useful when the selectivity factor is lower than 50 and the ee of the starting material is lower than 90%. To render this reaction synthetically useful, trifly-protected amine 3l was readily deprotected and converted to benzoyl-protected amine 10 under mild conditions without racemization (Fig. 2B). Finally, the chiral-iodinated amine 3l was converted to a diverse range of amines, illustrating the broad utility of this method to access a diverse range of chiral amines (Fig. 2C).

Fig. 2. Enrichment and elaboration of products. (A) Gram-scale synthesis, reaction with β-amino acid ligand and x-ray crystallography of 3l. (B) Deprotection of the trifly protecting group. (C) Functionalization of iodinated chiral amine 3l. Reaction conditions: a) 5 mol% Pd(PPh3)4, HCO2Na, dimethylformamide (DMF), 110°C; b) 1) PrMgCl-LiCl, tetrahydrofuran (THF), 0°C, 2) D2O; c) 2.5 mol% Pd(OAc)2, 5 mol% 2-dicyclohexylphosphino-2′,6′-dimethoxybiphenyl (S-Phos), 3-anisole-boronic-acid, K2CO3, acetonitrile/H2O, 100°C; d) CuCN, L-proline, DMF, 120°C; e) 20 mol% Cul, 40 mol% 1,10-phenanthroline, Cs2CO3, MeOH, 110°C; f) 1) PrMgCl-LiCl, THF, 0°C, 2) PhCHO, O°C to room temperature.

REFERENCES AND NOTES
METALLOPROTEINS

Structural basis for organohalide respiration

Martin Bommer,1* Cindy Kunze,2* Jochen Fesseler,1 Torsten Schubert,2 Gabriele Diekert,2† Holger Dobbeck1†

Organohalide-respiring microorganisms can use a variety of persistent pollutants, including trichloroethene (TCE), as terminal electron acceptors. The final two-electron transfer step in organohalide respiration is catalyzed by reductive dehalogenases. Here we report the x-ray crystal structure of PceA, an archetypal dehalogenase from Sulfurospirillum multivorans, as well as structures of PceA in complex with TCE and product analogs. The active site harbors a deeply buried norpseudo-B12 cofactor within a nitroreductase fold, also found in a mammalian B12 chaperone. The structures of PceA reveal how a cobalamin supports a reductive haloelimination exploiting a conserved B12-binding scaffold capped by a highly variable substrate-capturing region.

Aerobic microorganisms use alternative terminal electron acceptors during respiration, such as nitrate, sulfate, iron(III), or even organohalides. The accumulation of polluting organohalides such as perchloroethylene (PCE, also tetrachloroethene) and trichloroethene (TCE) in the environment, which have been heavily used for dry cleaning and degreasing, is problematic because of their toxicity; however, microbial organohalide respiration can transform these compounds into less toxic forms. Organohalide respiration requires reductive dehalogenases (RDases) for the central reduction step \( \text{(I)} \). In contrast to terminal reductases that contain prosthetic heme groups, molybdopterin, or flavins as cofactors, RDases harbor a corrinoid cofactor and two Fe/S clusters \( \text{(2)} \). RDases are able to convert some of the most noxious environmental pollutants, including halogenated phenols, dioxins, biphenyls, and aliphatic hydrocarbons. RDase genes were posited in databases await testing for functionality and determination of the substrate spectrum.

Several hundred RDase gene sequences were deposited in databases awaiting test for functionality and determination of the substrate spectrum. Low growth yields and the oxygen sensitivity of the RDases have hindered large-scale purification and biochemical characterization of RDases \( \text{(2)} \). Genetic manipulation of the bacterial isolates has thus far been difficult, and only recently was functional heterologous production of RDases reported, but it remains challenging \( \text{(4)} \). Structural data will help to resolve how RDases evolved, function, and specify the many different substrates, some of which have been present in the biosphere for less than a century.

Here we report the crystal structure of a reductive dehalogenase, PceA \( \text{(5)} \), of the microaerophilic epsilonproteobacterium Sulfurospirillum multivorans \( \text{(formerly Dehalospirillum multivorans)} \) \( \text{(6)} \) \( \text{(I)} \) in an empty state; \( \text{(ii)} \) in the presence of TCE; \( \text{(iii)} \) in the presence of the cis-dichloroethene \( \text{(cis-DCE)} \) \( \text{(product)} \) analog cis-dibromoethene \( \text{(cis-DBE)} \); and \( \text{(iv)} \) in the presence of iodide, a substitute for the leaving chlorine, at a maximum resolution of 1.6 Å \( \text{(7)} \). S. multivorans was isolated in the mid-1990s from activated sludge and possesses a flexible catabolism integrating numerous terminal reductases encoded in its genome \( \text{(8)} \). S. multivorans is able to couple the reductive dechlorination of PCE, TCE, or dichloroethene \( \text{(DCE)} \) to growth \( \text{(9, 10)} \) through its prototypical RDase PceA.

The 464 amino acids of PceA are structured in a compact \( \alpha/\beta \) fold domain (Fig. 1A). The structure can be divided into an N-terminal unit (residues 1 to 138), a norpseudo-B\(_12\)-binding core (residues 139 to 163 and 216 to 323), an insertion unit (residues 164 to 215), an iron-sulfur cluster binding unit (residues 324 to 394) and a C-terminal unit (residues 395 to 464) (Fig. S1). Two protomers in the \( \text{P}_2\text{\_4} \) asymmetric unit interact tightly to form a dimer with a twofold noncrystallographic symmetry. Two \( \alpha \) helices of the norpseudo-B\(_12\)-binding core and one \( \alpha \) helix of the N-terminal unit form a helical bundle with their symmetry mates. Along with extensive loop regions in the N- and C-terminal units, these bundles create the dimer interface. The interface covers 20% of the accessible surface area of the protomer, supporting a compact and stable dimeric arrangement. Using gel filtration, an apparent molecular mass of 89 kD (Fig. S2) was determined for PceA purified from the membrane fraction, which agrees with a dimeric rather than a monomeric structure as reported previously for the soluble wild-type enzyme \( \text{(5)} \).

RDases lack obvious sequence similarities to other enzyme families, and the fold of PceA is unlike that of known corrinoid-dependent methyltransferases \( \text{(11)} \) or mutases \( \text{(12)} \). The most similar protein with clear homology found was methylmalonic aciduria \( \text{cblc} \) type with homocysteinuria \( \text{MMACHC} \) \( \text{(33)} \) \( \text{(f i g . S 3 )} \). MMACHC is a \( \text{B}_12 \)-trafficking chaperone essential for the formation of adenosyl- or methylcobalamin in humans by catalyzing the reductive removal of the upper axial ligands from cyanocobalamin and alkylcobalamins. Structural homology is limited to the \( \text{B}_12 \)/norpseudo-B\(_12\)-binding core, which resembles the nitroreductase family fold \( \text{(14)} \) \( \text{(f i g . S 3 )} \). Consequently, RDases and MMACHC most likely evolved from a common ancestral \( \text{B}_12 \)-binding protein.

In addition to the norpseudo-B\(_12\) cofactor, PceA also harbors two \( \text{[4Fe-4S]} \) clusters. Short distances between the two \( \text{[4Fe-4S]} \) clusters and the proximal \( \text{[4Fe-4S]} \) cluster and the Co bound to the corrin ring are expected to allow for a rapid electron transfer within a protein monomer \( \text{(15)} \) \( \text{(f i g . 1B)} \). The proximal \( \text{[4Fe-4S]} \) cluster is in van der Waals contact distance to the C83 carboxamide side chain and C8 of the corrin ring \( \text{[for atom numbering, see (2)} \) \( \text{]} \), with the carboxamide N84 being in hydrogen bond distance to a p\(_3\)-sulfido ligand of the \( \text{[4Fe-4S]} \) cluster. The two active sites of the PceA dimer are at a Co-Co distance of 42 Å without cofactors between them, indicating two independent catalytic units per dimer (Fig. 1A).
Room-temperature enantioselective C–H iodination via kinetic resolution
Ling Chu, Kai-Jiong Xiao and Jin-Quan Yu

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DOI: 10.1126/science.1258538

Ensuring handedness when breaking C–H bonds
Many organic compounds are chiral: They manifest two distinct mirror-image variants, or enantiomers. Kinetic resolution can transform one enantiomer to a desired product while leaving its mirror image unmodified. Chu et al. applied this strategy to a reaction that replaces aryl carbon–hydrogen bonds with carbon–iodine bonds. They used a chiral palladium catalyst that reacts selectively with just one of two enantiomers of various benzylamine derivatives. In medicinal chemistry, such selective synthesis of individual enantiomers is essential for screening interactions with chiral biomolecules such as proteins.
Science, this issue p. 451

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