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Synthesis of Substituted Imidazolo[1,2-*a*]piperidinoses and Their Evaluation as Glycosidase Inhibitors

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The synthesis of substituted imidazolo[1,2-*a*]-L-*arabino*-piperidinoses is reported. The substituents are methyl, phenylmethyl, phenylethyl, cyclohexylethyl, pyridinylethyl, piperidinylethyl, phenylpropyl and hydroxymethyl. All substituents are connected to the imidazole moiety. Examination of the inhibitory properties of the newly synthesised compounds against a β-glucosidase (from almonds) and a β-galactosidase (from *Escherichia coli*) lead to the conclusion that the substitution of the C-2 position on the imidazole moiety with cyclohexylethyl or phenylethyl gives the best results (K_i = 2 and 4 nM, respectively, against a β-galactosidase) as compared with the non-substituted azasugar. The synthesis of the imidazolo[1,2-*a*]-D-*xylo*-piperidinose substituted with phenylethyl is also reported, as well as its inhibitory potency against the β-xylosidase from *Aspergillus niger*.

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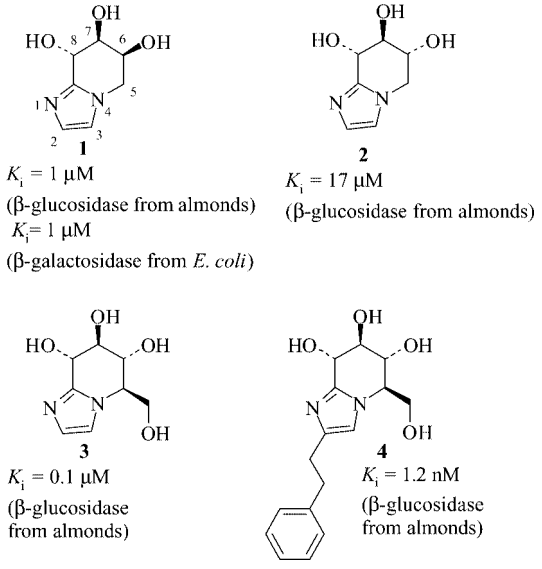
Introduction

Recent advances in the total synthesis of piperidine azasugars were reviewed recently.[1] The enzymatic mechanism of catalytic polysaccharide hydrolysis, using glycosidases, has been well studied and widely reported in a number of publications.[2–4] The putative oxocarbenium ion like transition state (TS), which is presumably produced during both the glycosylation and the deglycosylation steps of glycosides, appears to be in a half-chair conformation. This TS can be mimicked by some putative inhibitors, for example with azasugars fused to a tetrazole, a triazole or an imidazole, provided that one N-atom is attached to the pseudoanomeric C-atom, which assures the best requirement for a "lateral" or in-plane protonation demonstrated by Vasella.[5] In a previous publication we reported the synthesis of all eight stereomeric imidazolo[1,2-*a*]piperidinopentoses, and, in particular, the imidazolo-L-*arabino*- and -D-*xylo*-piperidinoses **1** and **2**, respectively.[6] All eight stereoisomers were tested against six glycosidases. Azasugar **1** was found to show a marked inhibition of β-glucosidase from almonds (K_i = 1 μM) and β-galactosidase from *Escherichia coli* (K_i = 1 μM), and azasugar **2** an inhibition of β-glucosidase from almonds (K_i = 17 μM). By studying the influence of substituents on the imidazole moiety of **3**, Vasella[7] has reached the conclusion that inhibition of a β-glucosidase is considerably increased when a phenylethyl substituent is attached to C-2 of the azasugar, as shown for **4** (Scheme 1).



Scheme 1. Examples of inhibition potency.

In a preliminary publication[8] we described the synthesis and the inhibitory potency of compounds possessing a phenylethyl or a hydroxymethyl group at C-2 or C-3 of **1**. The inhibitory potency of two of the four compounds was higher against β-glucosidase from almonds and β-galactosidase from *Escherichia coli* than for **1**. We therefore surmised that other substituents on the imidazole ring might be used in order to increase the inhibitory potency. However, we must note that our substrate does not possess the hy-

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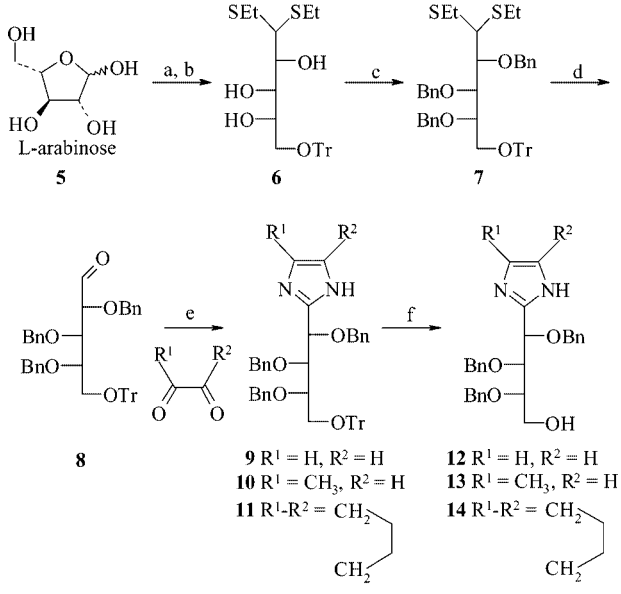
droxymethyl group on the sugar moiety that is present in Vasella's compounds **3** and **4**.

We described in a previous paper[6] a method that permits the synthesis of all the imidazolo[1,2-*a*]piperidinoses from D- and L-threose and from D- and L-erythrose, which were prepared from L-ascorbic and D-isoascorbic acids. However, for the specific synthesis of **1**, this method has some disadvantages. In order to arrive directly at the desired configuration of **1** or **2**, and in order to introduce different substituents on the imidazole moiety, we developed a new methodology starting from L-arabinose (for **1**) and from D-xylose (for **2**) by making use of glyoxal for the construction of the imidazole ring.

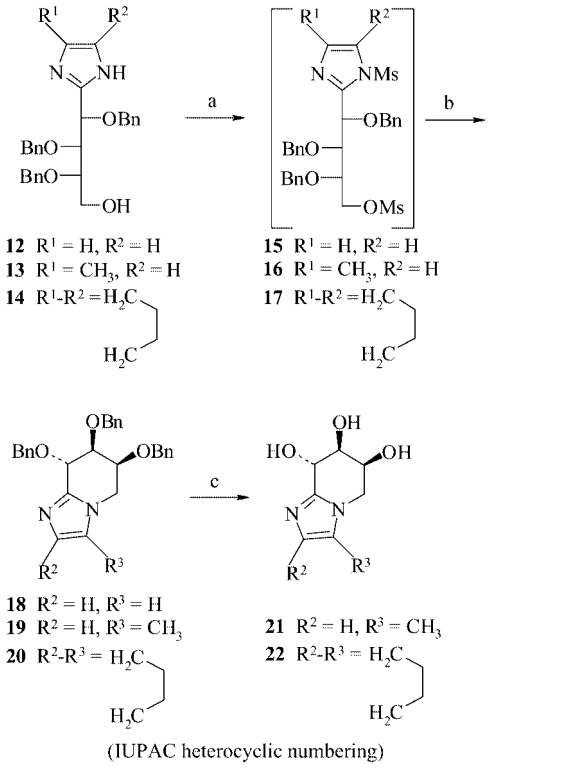
Results

Synthesis of Linear Imidazolyl-L-arabinose

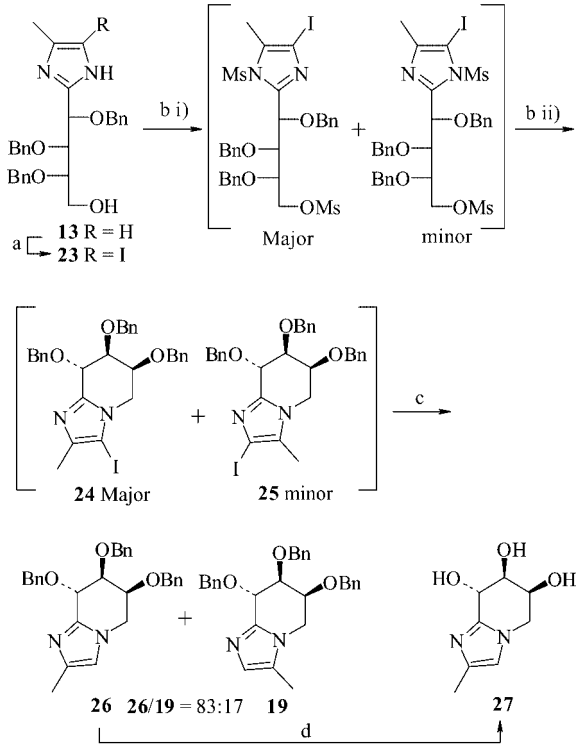
L-Arabinose (**5**) was converted into the diethyldithioacetal **6**[9,10] and the hydroxy groups were then specifically protected to give **7**[11] (Scheme 2). The aldehyde **8**, regenerated by treatment with NBS[12] in the presence of 2,6-lutidine, was condensed with two different glyoxals and with cyclohexane-1,2-dione to give the linear imidazolo sugars **9**–**11**, according to the method of Rothenberg.[13] The trityl groups were then removed to give **12**–**14**. It should be noted that both **10** and **13** occur as dynamic mixtures of two tautomers, only one of which is given in Scheme 2.



Scheme 2. Synthesis of the linear imidazolo-L-*arabino* sugars **12**–**14**: a) EtSH, concd. HCl, 0 °C, 15 min, 79%; b) TrCl, pyridine, DMAP, 80 °C, 3 h, 97%; c) DMF, NaH, nBu$_4$NI, BnBr, 96%; d) acetone/H_2O, 2,6-lutidine, NBS, 1 h, 71%; e) MeOH/NH_3, glyoxal derivatives, 70–80 °C, **9**: 62%, **11**: 53%; f) dioxane, 4 M HCl, 80 °C, **12**: 74%, **13**: 75% over two steps, **14**: 88%.



Scheme 3. Synthesis of imidazolo-L-arabinoses **21** and **22**: a) pyridine, MsCl, 0 °C; b) 80 °C, 2 h, yield over 2 steps: **18**: 77%, **19**: 81%, **20**: 93%; c) EtOH/AcOH, Pd(OH)$_2$/C, H_2, **21**: 78%, **22**: 72%.



Scheme 4. Synthesis of 2-methylimidazolo[1,2-*a*]-L-*arabino*-piperidinose (**27**): a) CH_3CN, NIS, room temp., 12 h, 82%; b) (i) pyridine, MsCl, 0 °C; (ii) 80 °C; c) THF, EtMgBr, 0 °C, 10 min, 70% overall yield from **23**; d) EtOH/AcOH, Pd(OH)$_2$/C, H_2, 69%.

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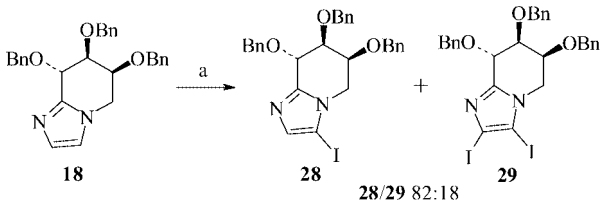
Mesylation of **12**–**14**, followed by heating to 80 °C, gave bicyclic compounds **18**–**20**, by an intramolecular nucleophilic substitution. It is noteworthy that the cyclisation of **13** gave only **19**, with the methyl group connected to C-3. This selectivity is obviously due to the fact that the steric interaction between the methyl and the mesyl group in **16** is less pronounced than in the alternative intramolecular approach. Palladium-catalysed hydrogenolysis of the benzyloxy groups of **19** and **20** gave azasugars **21** and **22**, respectively. The position of the methyl group of **21** was unambiguously assigned by NMR spectroscopy (the gHMBC shows cross-peaks between C-3 and the two 5-H protons; see Scheme 3).

In order to form **27**, which is the isomer of **21**, an iodine atom was introduced onto the imidazole ring of **13**, the reagent being NIS. Mesylation of **23** led preferentially to the compound in which the mesyl group has no steric interaction with the bulky iodine atom. As a consequence, cyclisation was supposed to give **24** as the major compound. Indeed, after mesylation of **23**, cyclisation led preferentially to **24**. Compounds **26** and **19** were obtained with an overall yield of 70% and in an 83:17 ratio, as determined by ^{1}H NMR spectroscopy, after deiodination. Subsequent hydrogenolytic debenzylation of **26** gave **27** (Scheme 4).

Introduction of Substituents at C-2 and C-3 of Imidazolo[1,2-*a*]piperidinoses

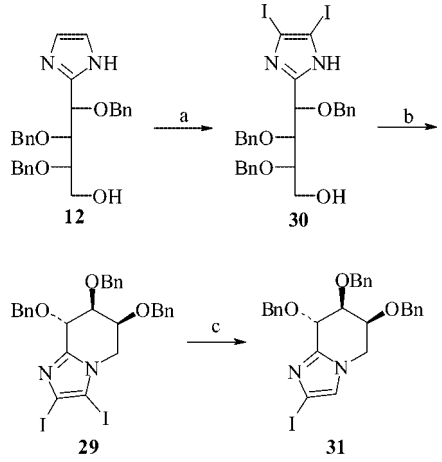
These reactions were performed in all cases starting from the cyclic mono- and diiodoimidazolopiperidinoses, i.e. **28**, **31** and **29**. The substitution of the iodine atom can be achieved with an organomagnesium derivative or according to the Sonogashira[14] methodology. Two strategies were employed for the preparation of mono- or diiodo derivatives. The 3-iodoimidazolopiperidinose **28** was synthesised according to the method described by Vasella[7] and according to what is known of the reactivity of imidazoles (Scheme 5).[15,16]

Direct access to the 2-iodoimidazolopiperidinose is not possible as introduction of the two iodine atoms on the bicyclic compound **18** requires a large excess of NIS and heating.[7] In contrast, when the linear compound **12** was treated with 2.5 equiv. of NIS at room temperature for 12 h, the



Scheme 5. Synthesis of 3-iodoimidazolo[1,2-*a*]-L-*arabino*-piperidinose (**28**): a) CH_3CN, NIS, 80 °C, 24 h, **28**: 57%.

diiodo compound **30** was obtained with a yield of 94%. After cyclisation of **30** to **29** (87%), the more reactive iodine atom at C-3 was removed to give **31** (87%; Scheme 6).[7,17] The bicyclic monoiodide derivatives **28** and **31** were characterised by ^{1}H and ^{13}C NMR spectroscopy (Table 1).



Scheme 6. a) CH_3CN, NIS, room temp., 12 h, 94%; b) pyridine, MsCl, 0–80 °C; 87%; c) CH_2Cl_2, EtMgBr, 0 °C, 87%.

Substitution of the Iodoimidazole Compounds by an Organomagnesium Derivative

Because of the importance of the imidazole ring in medicinal chemistry, numerous studies have been made to develop methodologies for the derivatisation of such compounds. The simplest approach for substitution of an imidazole ring is to prepare an anion on the imidazole moiety which is able to react with an electrophile. Thus, treatment

Table 1.Chemical shifts in the ^{1}H (400 MHz) and ^{13}C NMR (100.6 MHz) spectra for the C-2 and C-3 positions of the imidazoles **18**, **29**, **28** and **31**.

			18	**29**	**28**	**31**
^{1}H NMR	2-H		7.11	....	7.15	....
	3-H		6.84	–	–	6.90
^{13}C NMR	C-2	129.6	127.6	95.3	136.2	82.2
	C-3	120.3	119.1	82.5	70.1	124.5

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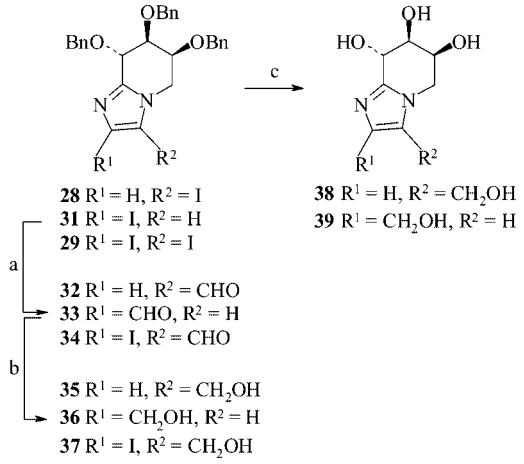
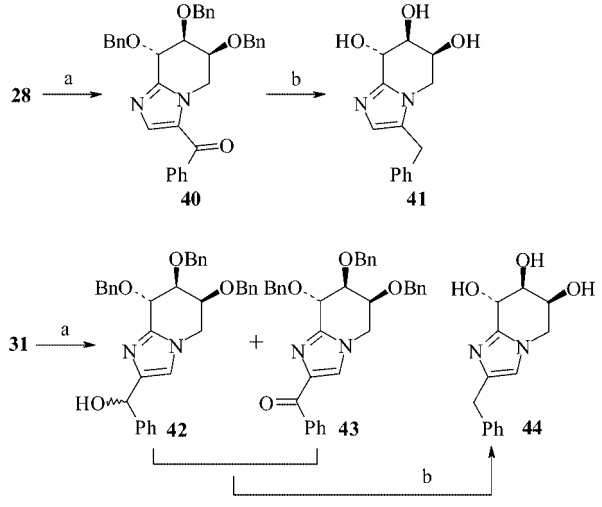
of iodides **28** and **31** with EtMgBr and then DMF[7] led to the formylimidazolo derivatives **32** and **33**, which, after reduction and deprotection, gave the hydroxymethyl derivatives **38** and **39**. The formyl group can also be fixed selectively on C-3 of the diiodo derivative **29** to give **34** and thence **37** (Scheme 7).



Scheme 7. a) (i) THF, EtMgBr, 0 °C, (ii) DMF, room temp., 12 h, **32**: 50%, **33**: 84%, **34**: 88%; b) THF, $LiAlH_4$, –78 °C to –30 °C, **35**: 85%, **36**: 83%, **37**: 68%; c) EtOH/AcOH, $Pd(OH)_2/C$, H_2, **38**: 87%, **39**: 68%.

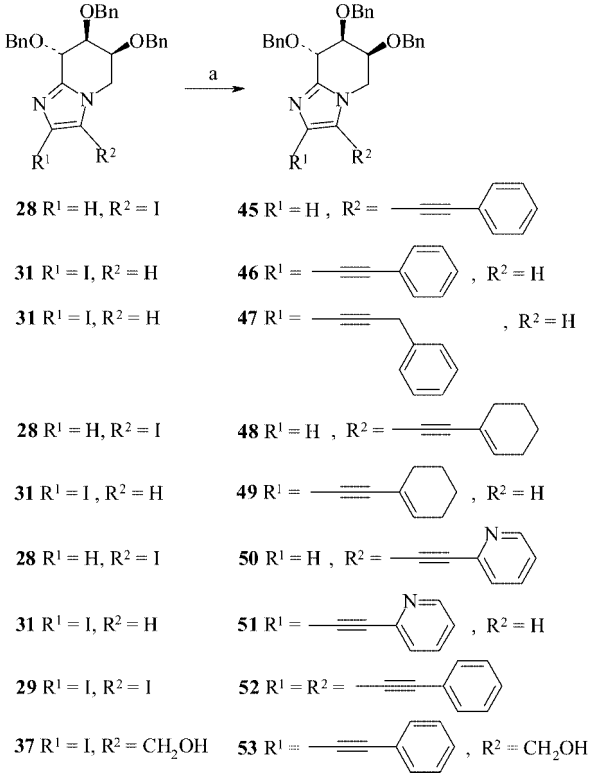
For the synthesis of the 2- and 3-benzoylimidazolo derivatives, the corresponding magnesium derivatives of **28** and **31** were first treated with benzaldehyde. When **28** was treated with EtMgBr and benzaldehyde, compound **40** was obtained with 37% yield. With BnMgBr, the reaction gave **40** in 84% yield. When **31** was sequentially treated with EtMgBr and benzaldehyde, a mixture of **42** and **43** was obtained after 3 h. The formation of **40** and **43** can be explained by an Oppenauer reoxidation. Timmermann et al.[18] have observed a similar reoxidation and studied its mechanism. Treatment of **40** with H_2 and $Pd(OH)_2/C$ as well as of the **42** and **43** mixture, gave **41** and **44** (Scheme 8).



Scheme 8. a) (i) THF, EtMgBr or BnMgBr, 0 °C, (ii) PhCHO, **40**: 84%, **42** + **44**: 97%; b) EtOH/AcOH, $Pd(OH)_2/C$, H_2, **41**: 60%, **44**: 73%.

Substitution of the Imidazole Ring by a Sonogashira Reaction

In order to improve the docking capabilities (by increasing the number of van der Waals interactions), we decided to increase the length of the lipophilic substituents. For that purpose the monoiodo derivatives **28**, **31** and **37**, as well as the diiodo derivative **29**, were submitted to the Sonogashira reaction conditions, i.e. tretament with monosubstituted acetylenes in the presence of $[Pd(PPh_3)_4]$, CuI and NEt_3 in DMF at 80 °C. These reactions led to the corresponding acetylenic adducts **45**–**53** (Scheme 9) with yields ranging from 71% to 100%.



Scheme 9. Coupling of monosubstituted acetylene derivatives with the imidazole moiety by the Sonogashira methodology: a) DMF, RCCH, $[Pd(PPh_3)_4]$, NEt_3, CuI, 80 °C.

Exhaustive hydrogenation of the triple bond and hydrogenolysis of the benzyl groups of **45**–**49**, **52** and **53** were performed in a one-pot procedure with H_2 in the presence of $Pd(OH)_2/C$ and led to compounds **54**–**60** (Scheme 10).

Treatment of the pyridinylethynyl derivative **50** with H_2 and $Pd(OH)_2/C$ in EtOH/AcOH gave a mixture of pyridine derivative **61** and piperidine compound **62** as the benzyloxy protection groups were only partially removed. After elimination of the catalyst and the solvent, the mixture was treated with BCl_3 to completely deprotect the hydroxy groups to give pure unprotected **61** and a mixture of **61** and **62**. Treatment of this mixture with H_2 and $Pd(OH)_2$ in EtOH/AcOH gave pure **62**. A similar strategy was applied to the ethynylpyridine derivative **51**, which gave **63** and thence **64** (Scheme 11).

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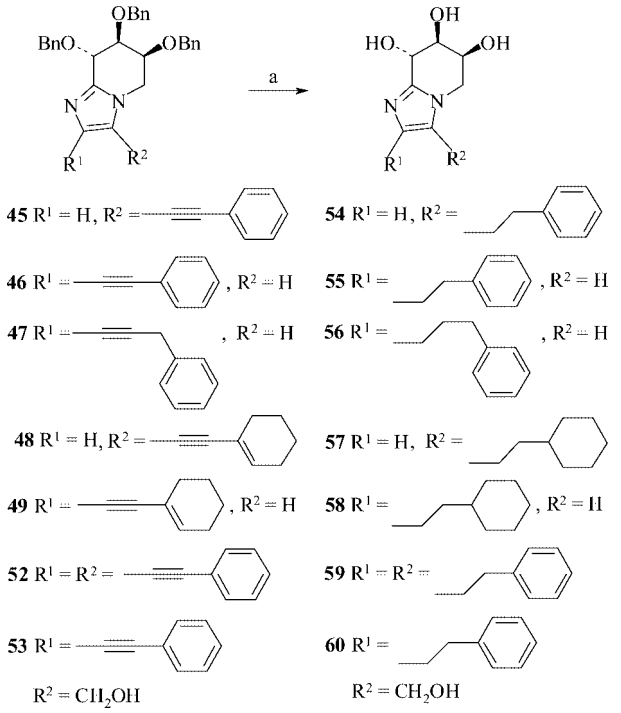
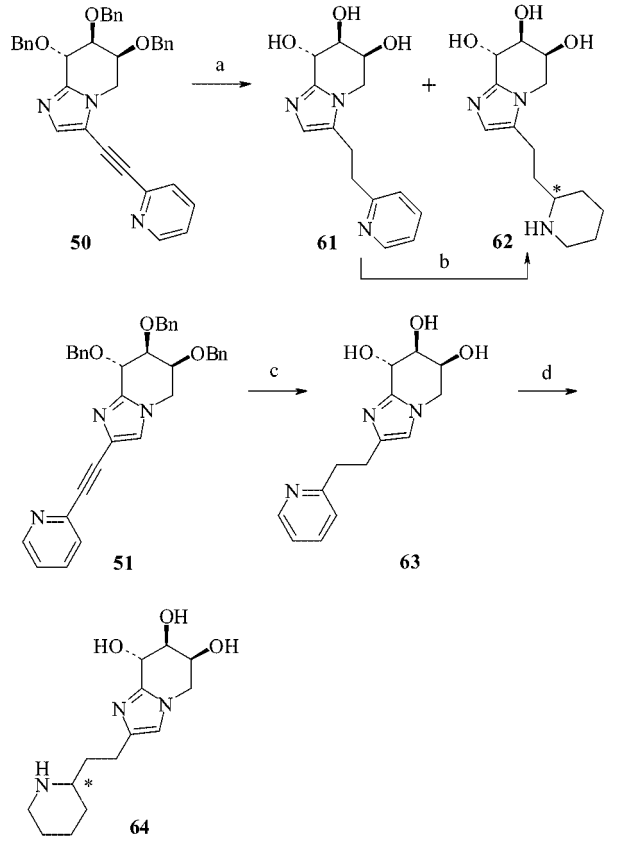


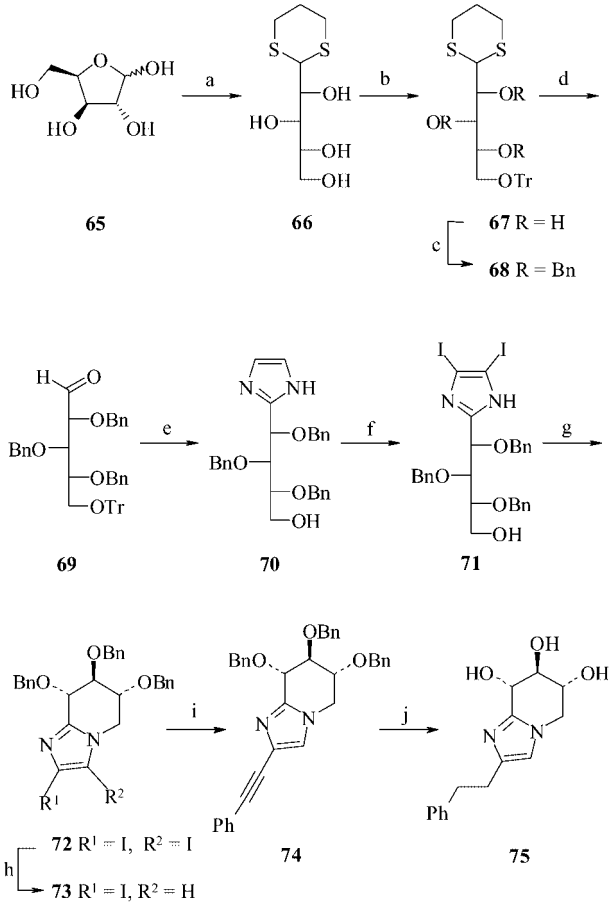
Scheme 10. Exhaustive catalytic hydrogenation of the triple bond and hydrogenolysis of the benzyl groups of **45**–**49**, **52** and **53**. a) EtOH/AcOH, $Pd(OH)_2/C$, room temp., overnight.



Scheme 11. Catalytic hydrogenation and hydrogenolytic debenzylation of the derivatives **50** and **51** bearing a pyridinylethyl group. a) (i) EtOH/AcOH, $Pd(OH)_2/C$, H_2; (ii) CH_2Cl_2, BCl_3, –70 to –20 °C, 12 h; b) EtOH/AcOH, $Pd(OH)_2/C$, H_2, room temp., 18 h; c) (i) EtOAc, Pd/C, H_2, room temp., 6 h; (ii) CH_2Cl_2, BCl_3, –70 to –20 °C, 16 h; d) EtOH/AcOH, $Pd(OH)_2/C$, H_2, room temp., 24 h.

Synthesis of 2-Phenylimidazolo[1,2-*a*]-D-*xylo*-piperidinose (75)

The synthesis of target molecule **75** was performed starting from D-xylose by making use of a methodology analogous to the one described above, as shown in Scheme 12.



Scheme 12. a) $HSCH_2CH_2CH_2SH$, concd. HCl, 0 °C, 15 min, 94%; b) pyridine, TrCl, DMAP, 80 °C, 2 h, 89%; c) DMF, NaH, nBu_4NI, BnBr, 0 °C to room temp., 93%; d) acetone/H_2O, NBS, 2,6-lutidine, room temp., 2 h, 45%; e) (i) MeOH/NH_3, glyoxal, –20 to 75 °C, 1 h; (ii) dioxane, 4 M HCl, 85 °C, 1 h, 73%; f) CH_3CN, NIS, room temp., 12 h, 83%;g) pyridine, MsCl, 0 to 80 °C, 2 h, 83%; h) CH_2Cl_2, EtMgBr, 0 °C to room temp., 87%; i) DMF, PhCCH, $[Pd(PPh_3)_4]$, NEt_3, CuI, 80 °C, 12 h, 71%; j) (i) EtOH/AcOH, $Pd(OH)_2/C$, H_2, room temp., 48 h; (ii) CH_2Cl_2, BCl_3, –78 to –20 °C, 12 h, 56%.

Enzymatic Essays

All the target azasugars were submitted to in vitro inhibition assays. As we noted in the Introduction, **1** and **2** are active as inhibitors against β-galactosidase from *Escherichia coli* and against β-glucosidase from almonds. Therefore, the synthesised molecules were tested against these two enzymes only, according to a methodology described in detail in the Experimental Section. Inhibition data were determined by Michaelis–Menten kinetics. Each compound tested behaved as a competitive inhibitor.

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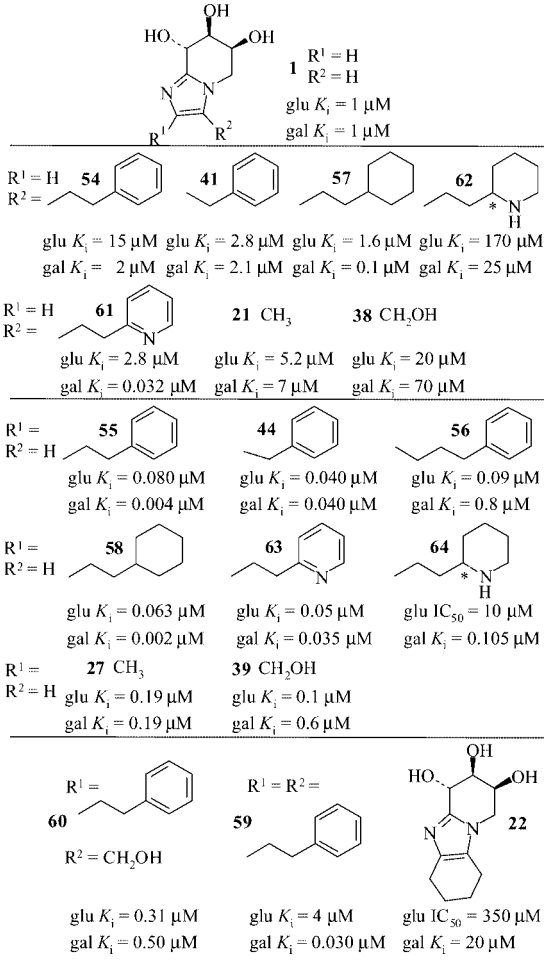
Effect of C-3 Substitution

Scheme 13 shows that the imidazolo[1,2-*a*]-L-*arabino*-piperidinoses substituted at C-3 generally have a lower inhibitory potency than the unsubstituted reference compound **1**. This observation is in agreement with the one made by Vasella.[19] This decrease of potency is most probably the consequence of an unfavourable interaction of the inhibitor with the enzyme's active site, the docking becoming more difficult because of steric crowding.

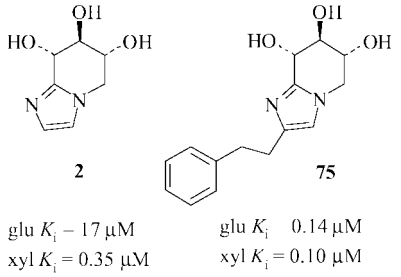


Scheme 13. Inhibition values (K_i in μM; in one instance IC_{50} in μM) of the substituted imidazolo[1,2-*a*]-L-*arabino*-piperidinoses against β-glucosidase (glu) from almonds and β-galactosidase (gal) from *Escherichia coli*.

Effect of C-2 Substitution

On the contrary, substituents at C-2 of compound **1** increase the inhibition toward the two enzymes significantly. The best inhibition was observed against β-galactosidase with **58** (K_i = 2 nM) and **55** (K_i = 4 nM). Such an enhanced inhibition, which is observed with the cyclohexylethyl substituent in **58** and with the phenylethyl substituent in **55**, reflects that hydrophobic interactions take place in the enzyme that favour inhibition. The presence of the N-atom in the pyridinylethyl and piperidineethyl derivatives **63** and **64** causes a decrease of the inhibitory potency against the β-galactosidase when compared with **55** and **58**. The length of the chain that separates the imidazole from the phenyl moiety has an optimal effect on inhibition against β-galactosidase with two carbon atoms (comparison of **55** with **44** and **56**). With the β-glucosidase the length of the chain seems to have no great influence. Compound **22**, which contains a rigid tetrahydrobenzimidazole moiety, is much less active against β-glucosidase and against the β-galactosidase than **1** (IC_{50} = 350 μM and K_i = 20 μM). The disubstituted compounds **59** and **60** have K_i values between 0.03 and 4 μM towards the two enzymes.

Compound **2** has an inhibitory activity on the β-glucosidase with a K_i of 17 μM. Since **2** has a *xylo* configuration, we determined its inhibition potency towards the β-xylosidase from *Aspergillus niger* and found a K_i of 0.35 μM. For **75**, substitution at C-2 decreases these two values to 0.14 and 0.10 μM (Scheme 14). Here also the hydrophobic phenylethyl group enhances inhibition but much more so against the β-glucosidase (more than 100 times) than against the β-xylosidase (ca. 3 times).



Scheme 14. Inhibition values (K_i in μM) of the substituted imidazolo[1,2-*a*]-D-*xylo*-piperidinoses against β-glucosidase from almonds (glu) and the β-xylosidase from *Aspergillus niger* (xyl).

Conclusion

The herein described approach provides some potent glycosidase inhibitors with interesting selectivity profiles towards the evaluated enzymes. This completes the panel of experimental tools already available in glycobiology.

Experimental Section

General: Flash chromatography: silica gel (Merck 60 or Macherey–Nagel 60 M, 230–400 mesh). TLC: silica gel on aluminium sheets (Merck 60 HF_{254}); the spots were viewed under UV light or by heating with a heat gun after spraying with a solution of $KMnO_4$ (20 g) and Na_2CO_3 (40 g) in H_2O (1 L) or with a solution of phosphomolybdic acid (5% in EtOH 96%). M.p.: Kofler hot-bench or Büchi-SMP apparatus; corrected values. Optical rotations were measured at 20 °C with a Perkin–Elmer Model 341LC; the rotatory power of compounds of which we had only a small quantity was measured in a 40-μL cell at the wavelength indicated. ^1H and ^{13}C NMR spectra: 400 and 100.6 MHz (Bruker Avance 400 spectrometer at 20 °C). Internal references for ^1H NMR: $SiMe_4$ (δ = 0.00 ppm), $CDCl_3$ (δ = 7.26 ppm), CD_3OD (δ = 3.30 ppm), C_6D_6 (δ = 7.16 ppm), [D_4]TSP for spectra in D_2O (δ = 0.00 ppm); for ^{13}C NMR: $CDCl_3$ (δ = 77.03 ppm), CD_3OD (δ = 49.02 ppm), C_6D_6 (δ = 128.04 ppm); δ in ppm and J in Hz. High-resolution mass spectra

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were measured at the University of Basle and at the University Louis Pasteur, Strasbourg. Microanalyses were carried out by the Service Central de Microanalyses of the CNRS, 69390 Vernaison, France. "MeOH + NH_3" stands for a solution of pure MeOH saturated at room temp. with NH_3 (ex gas form). Each preparation is described only once in full detail, along with its workup and chromatographic methodologies. In some instances, minor modifications were used; they are indicated explicitly.

Enzymatic Assays: Glycosidases [β-glucosidase (EC, 3.2.1.21) from almonds, β-galactosidase from *Escherichia coli* (EC, 3.2.1.23), β-xylosidase from *Aspergillus niger* (EC, 3.2.1.37)] and their corresponding substrates were purchased from Sigma Co. Spectrophotometric assays were performed at the optimum pH for each enzyme.[20] Substrate for the enzymes and conditions: [*p*-nitrophenyl-β-D-glucopyranoside for β-glucosidase (K_m = 1.3 mM, pH = 5.0), *p*-nitrophenyl-β-D-galactopyranoside for β-galactosidase (K_m = 0.4 mM, pH = 7) and *p*-nitrophenyl-β-D-xylopyranoside for β-xylosidase (K_m = 0.5 mM, pH = 5.0)]. The release of *p*-nitrophenol was measured continuously at 405 nm with an HP-8453 spectrophotometer to determine initial velocities. All kinetics were performed at 25 °C and the reaction was started by the addition of enzyme in a 1-mL assay medium (AcOH/AcOK buffer 50 mM, or K_2HPO_4/KH_2PO_4 buffer 20 mM according to the desired pH value) using substrate concentrations around the K_m value of each enzyme. The substituted compounds of Schemes 13 and 14 are poorly soluble in water, therefore we dissolved them in DMSO to a 100 mM concentration. For the tests, we prepared solutions of the enzymes, the substrates and the inhibitors in the corresponding buffer and added DMSO so that the concentration of DMSO was 1%. Previously, the stability of the enzymes in different concentrations of DMSO was controlled. As a matter of fact, the activity of the enzymes did not change when the solution contained 1% DMSO. The K_i values were determined by the Dixon graphical procedure.[20,21]

(2*R*,3*S*,4*S*)-1,1-Bis(ethylsulfanyl)-5-(trityloxy)pentane-2,3,4-triol (6): A solution of L-arabinose diethyldithioacetal[9,10] (1.28 g, 5.00 mmol), trityl chloride (2.09 g, 7.50 mmol) and DMAP (50 mg) in anhydrous pyridine (20 mL) was heated at 80 °C whilst stirring for 3 h. After concentration to dryness, the residue was purified by flash chromatography (EtOAc/cyclohexane, 2:8) to give **6** (2.41 g, 97%) as a colourless foam of which a small quantity was recrystallised from EtOAc. M.p. 126–127 °C. Foam: $[\alpha]_D^{20}$ = +30 (*c* = 3.3, $CHCl_3$); enantiomer:[11] $[\alpha]_D^{20}$ = –29.8 (*c* = 1.06, $CHCl_3$); crystals: $[\alpha]_D^{20}$ = +11 (*c* = 1.1, MeOH). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 1.17 (t, 3 H, C*H*$_3$CH$_2$S), 1.19 (t, 3 H, 3 H, C*H*$_3$CH$_2$S), 2.49–2.71 (m, 4 H, CH$_3$C*H*$_2$S), 3.08 (br. d, 1 H, *H*OC-3), 3.29 (dd, 1 H, H-5a), 3.33 (d, 1 H, *H*OC-4), 3.38 (dd, 1 H, H-5b), 3.70 (d, 1 H, *H*OC-4), 3.81 (br. d, 1 H, H-2), 3.94 (m, 1 H, H-4), 4.05 (d, 1 H, H-1), 4.17 (t, 1 H, H-3), 7.13–7.29 and 7.44–7.46 (m, 15 H, C*H* arom.) ppm; $J_{1,2}$ = 9.3, $J_{4,5a}$ = 5.2, $J_{4,5b}$ = 5.6, $J_{5a,5b}$ = 9.6, $J_{CH_2-CH_3}$= 7.3, $J_{2,OH}$ = 1.7, $J_{3,OH}$ = 8.6, $J_{4,OH}$ = 6.9 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 14.2 (*C*H$_3$), 14.3 (CH$_3$), 23.4 (*C*H$_2$), 25.1 (*C*H$_2$), 55.2 (C-1), 64.8 (C-5), 70.0 (C-3), 70.8 (C-2), 71.8 (C-4), 86.6 (*C*Ph$_3$), 126.8, 127.6, 128.4 (*C*H arom.), 143.4 ($C_{quat.}$ of phenyls of trityl) ppm.

(2*R*,3*S*,4*S*)-2,3,4-Tris(benzyloxy)-1,1-bis(ethylsulfanyl)-5-(trityloxy)pentane (7): NaH (ca. 60% in oil, 1.90 g, ca. 47 mmol) was added, under argon, to a solution of **6** (5.63 g, 11.3 mmol) and *n*Bu$_4$NI (200 mg) in DMF at 0 °C. Once hydrogen formation had ceased, BnBr (4.50 mL, 38 mmol) was added, and the reaction mixture stirred at room temperature for 2 h. MeOH was then added carefully (2 mL) and the resulting solution concentrated to dryness in vacuo. The residue was dissolved in CH_2Cl_2 (150 mL), washed with H_2O (80 mL) and brine (80 mL), dried ($MgSO_4$) and filtered. After evaporation of the solvents, the residue was purified by flash chromatography (EtOAc/cyclohexane, 5:95) to give compound **7** as a pure yellow oil (8.35 g, 96%). $[\alpha]_D^{20}$ = +4 (*c* = 1.1, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 1.16 (t, 3 H, C*H*$_3$CH$_2$S), 1.19 (t, 3 H, C*H*$_3$CH$_2$S), 2.55 (q, 2 H, CH$_3$C*H*$_2$S), 2.67 (q, 2 H, CH$_3$C*H*$_2$S), 3.35 (dd, 1 H, H-5a), 3.57 (dd, 1 H, H-5b), 3.78 (m, 1 H, H-4), 3.96 (t, 1 H, H-2), 4.02 (d, 1 H, H-1) 4.38 (t, 1 H, H-3), 4.48 (d, *J* = 11.6 Hz, 1 H, C*H*Ph), 4.54 (d, *J* = 11.1 Hz, 1 H, C*H*Ph), 4.66 (d, *J* = 11.6 Hz, 1 H,C*H*Ph), 4.69 (d, *J* = 11.6 Hz, 1 H, C*H*Ph), 4.76 (d, *J* = 11.3 Hz, 2 H, 2×C*H*Ph), 7.05, 7.19–7.40, 7.45–7.55 (m, 30 H, C*H* arom.) ppm; $J_{1,2}$ = 5.3, $J_{2,3}$ = 5.5, $J_{3,4}$ ≈ 5.8, $J_{4,5a}$ = 5.0, $J_{4,5b}$ = 3.0, $J_{5a,5b}$ = 10.3 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 14.2 (*C*H$_3$), 14.3 (*C*H$_3$), 24.7 (*C*H$_2$), 25.0 (*C*H$_2$), 54.2 (C-1), 62.5 (C-5), 71.8 (*C*H$_2$Ph), 74.3 (*C*H$_2$Ph), 74.7 (*C*H$_2$Ph), 79.4 (C-4 and C-3), 82.8 (C-2), 86.6 (*C*Ph$_3$), 126.6 to 128.5 (*C*H arom.), 138.2, 138.5, 138.6 ($C_{quat.}$ of phenyls of benzyls), 143.7 ($C_{quat.}$ of phenyls of trityl) ppm. $C_{49}H_{52}O_4S_2$ (769.09): calcd. C 76.53, H 6.82, S 8.34; found C 76.5, H 6.7, S 8.7.

(2*R*,3*S*,4*S*)-2,3,4-Tris(benzyloxy)-5-(trityloxy)pentanal (8): 2,6-Lutidine (2.6 mL, 22.4 mmol) and then NBS (1.60 g, 8.94 mmol) were added in small portions to a stirred solution of **7** (1.01 g, 1.38 mmol) in acetone (25 mL) and H_2O (4 mL) under argon and at room temperature. After stirring for 1 h, the reaction was quenched with saturated aqueous solutions of $NaHCO_3$ (25 mL) and $Na_2S_2O_3$ (25 mL). Acetone was evaporated and the aqueous phase extracted with EtOAc. The organic phase was dried ($MgSO_4$), filtered and the solvent evaporated to dryness in vacuo. The residue was purified by flash chromatography (EtOAc/cyclohexane, 1:9) to give **8** (646 mg, 71%) as a syrup. $[\alpha]_D^{20}$ = +20 (*c* = 1, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 3.30 (dd, 1 H, H-5a), 3.66 (dd, 1 H, H-5b), 3.84 (m, 1 H, H-4), 4.15 (dd, 1 H, H-2), 4.29 (dd, 1 H, H-3), 4.33 and 4.74 (AB, J_{gem} = 11.4 Hz, 2 H, C*H*$_2$Ph), 4.40 and 4.44 (AB, J_{gem} = 11.1 Hz, 2 H, C*H*$_2$Ph), 4.48 and 4.62 (AB, J_{gem} = 11.8 Hz, 2 H, C*H*$_2$Ph), 7.00, 7.18–7.38, 9.50 (m, 30 H, C*H* arom.), 9.65 (d, 1 H, H-1) ppm; $J_{1,2}$ = 1.2, $J_{2,3}$ = 3.6, $J_{3,4}$ = 8.2, $J_{4,5a}$ = 4.1, $J_{4,5b}$ ≈ 1, $J_{5a,5b}$ = 10.3 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 62.1 (C-5), 71.9 (*C*H$_2$Ph), 73.1 (*C*H$_2$Ph), 73.9 (*C*H$_2$Ph), 77.7 (C-4), 78.6 (C-3), 84.2 (C-2), 86.7 (*C*Ph$_3$), 126.8–128.9 (*C*H of phenyls), 137.2, 137.5, 138.0 ($C_{quat.}$ of phenyls), 143.9 ($C_{quat.}$ of phenyls), 202.1 (C-1) ppm. $C_{45}H_{42}O_5$ (662.83): calcd. C 81.54, H 6.39; found C 81.6, H 6.5.

2-[(1*S*,2*R*,3*S*)-1,2,3-Tris(benzyloxy)-4-(trityloxy)butyl]-1*H*-imidazole (9): A solution of glyoxal (40% in H_2O, 220 μL, 1.92 mmol) was added to a solution of **8** (182 mg, 0.27 mmol) in MeOH (4 mL) saturated with NH_3 at –20 °C. The reaction mixture was warmed up slowly to room temperature then heated to 70 °C for 1 h (NH_3 gas evolves!). After evaporation of the solvent to dryness, the residue was dissolved in H_2O and EtOAc. The organic phase was extracted, dried ($MgSO_4$), filtered and concentrated in vacuo. The residue was purified by flash chromatography (EtOAc/cyclohexane, 2:8) to give **9** as a colourless solid (123 mg, 62%). M.p. 156–158 °C (MeOH/pentane). $[\alpha]_D^{20}$ = +11 (*c* = 1, MeOH). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 3.17 (dd, 1 H, H-4a), 3.50 and 4.17 (AB, J_{gem} = 10.3 Hz, 2 H, C*H*$_2$Ph), 3.63 (dd, 1 H, H-4b), 3.91 (ddd, 1 H, H-3), 4.04 (dd, 1 H, H-2), 4.18 and 4.25 (AB, J_{gem} = 12.1 Hz, 2 H, C*H*$_2$Ph), 4.28 and 4.70 (AB, J_{gem} = 11.3 Hz, 2 H, C*H*$_2$Ph), 5.12 (d, 1 H, H-1), 6.66 (d, 2 H, CH arom.), 6.94 (br. s, 2 H, H-4′, H-5′), 7.05–7.30, 7.35–7.42 (m, ≈ 30 H, C*H* arom.) ppm; $J_{1,2}$ = 2.2, $J_{2,3}$ = 8.8, $J_{3,4a}$ = 3.8, $J_{3,4b}$ = 1.8, $J_{4a,4b}$ = 10.3 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 62.2 (C-4), 71.9 (*C*H$_2$Ph), 72.2 (*C*H$_2$Ph), 74.6 (*C*H$_2$Ph), 74.9 (C-1), 77.9 (C-3), 80.6 (C-2), 86.6 (*C*Ph$_3$), 126.9–128.8 (*C*H arom.), 137.5, 138.5 (3×$C_{quat.}$ of phenyls of benzyls), 144.0 ($C_{quat.}$ of phenyls of trityl), 146.9 (C-2′) ppm. $C_{47}H_{44}N_2O_4$

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(700.89): calcd. C 80.54, H 6.33, N 4.00; found C 80.3, H 6.5, N 4.0.

4(5)-Methyl-2-[(1*S*,2*R*,3*S*)-1,2,3-tris(benzyloxy)-4-(trityloxy)butyl]-1*H*-imidazole (10): See **13**.

2-[(1*S*,2*R*,3*S*)-1,2,3-Tris(benzyloxy)-4-(trityloxy)butyl]-4,5,6,7-tetrahydro-1*H*-benzimidazole (11): This compound was prepared from **8** (1.98 g, 2.99 mmol), MeOH (65 mL) and cyclohexanedione (608 mg, 5.42 mmol) analogously to **9**. Compound **11** was isolated as a colourless solid (1.195 g, 53%). M.p. 99–101 °C (EtOAc/pentane). $[\alpha]_D^{20}$ = +7 (*c* = 1, $CHCl_3$). ^{1}H NMR (400 MHz,$CDCl_3$): δ = 1.78 (br. s, 4 H, H-7′,H-8′), 2.37, 2.64 (2 × br. s, 4 H, H-6′, H-9′), 3.26 (dd, 1 H, H-4a), 3.73 and 4.33 (AB, J_{gem} = 10.3 Hz, 2 H, CH_2Ph), 3.75 (dd, 1 H, H-4b), 3.98 (ddd, 1 H, H-3), 4.15 (dd, 1 H, H-2), 4.27 and 4.37 (AB, J_{gem} = 11.6 Hz, 2 H, CH_2Ph), 4.34 and 4.75 (AB, J_{gem} = 11.6 Hz, 2 H, CH_2Ph), 5.10 (d, 1 H, H-1), 6.77 (m, 2 H, H arom.), 7.10–7.35 and 7.47–7.50 (m, ≈ 28 H, C*H* arom.), 8.96 (br. s, 1 H, NH) ppm; $J_{1,2}$ = 2.5, $J_{2,3}$ = 8.8, $J_{3,4a}$ = 3.5, $J_{3,4b}$ = 2.0, $J_{4a,4b}$ = 10.3 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 21.3, 22.6–23.9 (C-6′, C-7′, C-8′, C-9′), 62.0 (C-4), 71.5 (*C*H_2Ph), 71.9 (*C*H_2Ph), 74.6 (*C*H_2Ph), 75.2 (C-1), 77.8 (C-3), 80.8 (C-2), 86.4 (*C*Ph_3), 124.2 (C-4' or C-5′), 126.6–128.7 (CH arom.), 135.1 (C-4′ or C-5′), 137.6, 137.7, 138.4 (3 × $C_{quat.}$ of phenyls), 143.9 ($C_{quat.}$ of phenyls), 144.2 (C-2′) ppm. $C_{51}H_{50}N_2O_4$ (754.98): calcd. C 81.14, H 6.68, N 3.71; found C 81.4, H 6.8, N 3.8.

(2*S*,3*R*,4*S*)-2,3,4-Tris(benzyloxy)-4-(1*H*-imidazol-2-yl)butan-1-ol (12): A solution of **9** (1,931 g, 2.75 mmol) in dioxane (60 mL) was treated with 4 M HCl (40 mL) at room temperature, then heated to 80 °C for 2 h. The reaction mixture was cooled to 0 °C and basified with 4 M NaOH. The dioxane was evaporated and the aqueous phase extracted with CH_2Cl_2. The organic phase was dried ($MgSO_4$), filtered and concentrated in vacuo. The residue was purified by flash chromatography (EtOAc/cyclohexane, 1:9) to give **12** as a colourless solid (939 mg, 74%). M.p. 95–96 °C (EtOAc/hexane). $[\alpha]_D^{20}$ = +36 (*c* = 1, $CHCl_3$). ^{1}H NMR (400 MHz, C_6D_6): δ = 3.70 (dt, 1 H, H-3), 3.76 (dd, 1 H, H-4a), 3.88 (dd, 1 H, H-4b),3.91 and 4.55 (AB, J_{gem} = 10.8 Hz, 2 H, CH_2Ph), 4.03 (dd, 1 H, H-2), 4.05 and 4.15 (AB, J_{gem} = 11.6 Hz, 2 H, CH_2Ph), 4.11 and 4.35 (AB, J_{gem} = 11.6 Hz, 2 H, CH_2Ph), 5.03 (d, 1 H, H-1), 6.94–7.20 (m, 15 H, C*H* arom.) ppm; $J_{1,2}$ = 3.2 Hz, $J_{2,3}$ = 7.6, $J_{3,4a}$ = 2.8, $J_{3,4b}$ = 3.6, $J_{4a,4b}$ = 12.0 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 60.0 (C-4), 71.8 (*C*H_2Ph), 72.0 (*C*H_2Ph), 74.8 (*C*H_2Ph), 75.2 (C-1), 78.7 (C-3), 80.8 (C-2), 116.4 (C-4′, C-5′), 127.6–128.4 (*C*H arom.), 137.3, 137.7, 138.0 (3 × $C_{quat.}$ of phenyls), 146.7 (C-2′) ppm. $C_{28}H_{30}N_2O_4$ (458.56): calcd. C 73.34, H 6.59, N 6.11; found C 73.5, H 6.7, N 6.3.

(2*S*,3*R*,4*S*)-2,3,4-Tris(benzyloxy)-4-[4(5)-methyl-1*H*-imidazol-2-yl]-butan-1-ol (13): A solution of pyruvaldehyde (40% in H_2O, 5 mL) was added to a solution of **8** (2.99 g, 4.52 mmol) in MeOH (60 mL) saturated with NH_3 at –20 °C. The reaction mixture was warmed up slowly to room temperature, then heated to 75–80 °C for 30 min (NH_3 gas evolved!). After evaporation of the solvent to dryness, the residue was dissolved in H_2O and EtOAc. The organic phase was extracted, dried ($MgSO_4$), filtered and concentrated in vacuo. The crude compound **10** in dioxane (45 mL) was treated with 4 M HCl (45 mL) at room temperature then heated to 80 °C for 2 h. The reaction mixture was cooled to 0 °C and basified with 4 M NaOH. The dioxane was evaporated and the aqueous phase extracted with CH_2Cl_2. The organic phase was dried ($MgSO_4$), filtered and concentrated in vacuo. The residue was purified by flash chromatography to give **13** (1.570 g, 75%). $[\alpha]_D^{20}$ = +33 (*c* = 1, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$), mixture of rotamers, δ = 2.10, 2.26 [2 × br. s (rotamers), 3 H, CH_3], 3.1 (br. s, 1 H, OH), 3.75–3.81 (m, 2 H, H-3, H-4a), 3.90–4.01 (m, 2 H, H-2, H-4b), 3.97 (d, 1 H, C*H*Ph, *J* = 10.9 Hz), 4.27 and 4.39 (AB, J_{gem} = 11.6 Hz, 2 H, CH_2Ph), 4.32 and 4.54 (AB, J_{gem} = 11.5 Hz, 2 H, CH_2Ph), 4.49–4.61 (very br. d, 2 H, C*H*Ph), 4.95 (br. s, 1 H, H-1), 6.68 (br. s, 1 H, H-5′), 7.15–7.29 (m, 15 H, CH arom.), 9.2, 9.4 (2 × br. s, 1 H, N*H*) ppm. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 10.0, 13.5 (CH_3, rotamers), 59.9 (C-4), 71.7 (*C*H_2Ph), 71.9 (*C*H_2Ph), 74.9 (*C*H_2Ph), 75.3 (C-1), 78.8 (C-3), 80.7 (C-2), 112.1 and 125.2 (C-5′ rotamers), 127.6–128.3 (C-4′, *C*H of phenyls), 137.4, 137.8, 138.1 (3 × $C_{quat.}$ of phenyls of benzyls), 145.7 and 145.9 (C-2′, rotamers) ppm. HR-MS: calcd. for $[M + H]^+$ ($C_{29}H_{33}N_2O_4$) 473.2440; found 473.2433.

(2*S*,3*R*,4*S*)-2,3,4-Tris(benzyloxy)-4-(4,5,6,7-tetrahydro-1*H*-benzimidazol-2-yl)butan-1-ol (14): This compound was prepared from **11** (1.191 g, 1.58 mmol), dioxane (20 mL) and 4 M HCl analogously to **12**. It was isolated as a colourless foam (712 mg, 88%). M.p. 162–163 °C (EtOAc/hexane). $[\alpha]_D^{20}$ = +33 (*c* = 1, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 1.77 (m, 4 H, H-7′ and H-8′), 2.40, 2.59 (2 × m, 4 H, H-6′, H-9′), 3.82–3.90 (m, 2 H, 2 × H-4), 4.13 (dd, 1 H, H-2), 4.33 (ddd, 1 H, H-3), 4.50 and 4.57 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 4.63 and 4.85 (AB, J_{gem} = 12.1 Hz, 2 H, CH_2Ph), 4.64 and 4.69 (AB, J_{gem} = 12.4 Hz, 2 H, CH_2Ph), 4.69 (d, 1 H, H-1), 7.21–7.35 (m, 15 H, H arom.) ppm; $J_{1,2}$ = 3.7, $J_{2,3}$ = 1.8, $J_{3,4}$ = 8.7 and 7.5 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 20.1, 22.7, 23.3, 24.1 (C-6′, C-7′, C-8′, C-9′), 42.1 (C-4), 71.1 (C-1), 71.3 (*C*H_2Ph), 71.4 (*C*H_2Ph), 72.0 (C-3), 72.4 (*C*H_2Ph), 74.1 (C-2), 125.4 (C-4′ or C-5′), 127.3–128.4 (*C*H arom.), 136.7 (C-4′ or C-5′), 137.6, 137.8 and 138.3 (3 × $C_{quat.}$ of phenyls), 139.8 (C-2′) ppm. $C_{32}H_{36}N_2O_4$ (512.65): calcd. C 74.97, H 7.08, N 5.46; found C 74.8, H 7.1, N 5.3.

(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-5,6,7,8-tetrahydroimidazo[1,2-*a*]-pyridine (18): MsCl (1.8 mL, 23 mmol) was added to a stirred solution of **12** (3.00 g, 6.57 mmol) in anhydrous pyridine (60 mL) at 0 °C under argon. After 10 min, the reaction mixture was warmed up slowly to 80 °C, stirred at this temperature for 2 h, cooled to room temperature and then quenched with MeOH. The solvent was evaporated and the residue was dissolved in CH_2Cl_2. The organic phase was washed with H_2O and brine, dried ($MgSO_4$), filtered and the solvent evaporated in vacuo. The residue was purified by flash chromatography (EtOAc/cyclohexane, 5:5) to give **18** (2.24 g, 77%). $[\alpha]_D^{20}$ = +36 (*c* = 1, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 4.08 (dd, 1 H, H-5a), 4.12 (dd, 1 H, H-5b), 4.12 (dd, 1 H, H-7), 4.34 (ddd, 1 H, H-6), 4.53 and 4.59 (AB, J_{gem} = 12.0 Hz, 2 H, CH_2Ph), 4.63 and 4.68 (AB, J_{gem} = 12.4 Hz, 2 H, CH_2Ph), 4.71 and 4.86 (AB, J_{gem} = 12.0 Hz, 2 H, CH_2Ph), 4.81 (d, 1 H, H-8), 6.84 (s, 1 H, H-3), 7.11 (s, 1 H, H-2), 7.22–7.36 (m, 15 H, H arom.) ppm; $J_{5a,6}$ = 6.8, $J_{5b,6}$ = 8.8, $J_{5a,5b}$ = 11.6, $J_{6,7}$ = 2.0, $J_{7,8}$ = 3.6 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 44.6 (C-5), 70.2 (C-8), 71.6 (*C*H_2 Ph), 71.7 (C-6), 71.8 (*C*H_2Ph), 72.4 (*C*H_2Ph), 74.6 (C-7), 119.1 (C-3), 127.6–128.5 (C-2, *C*H of phenyls), 137.5, 137.7, 137.9 (3 × $C_{quat.}$ of phenyls), 150.3 (C-8a) ppm. HR-MS: calcd. for $[M + H]^+$ ($C_{28}H_{29}N_2O_3$) 441.2178; found 441.2172.

(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-3-methyl-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine (19): This compound was prepared from **13** (310 mg, 0.66 mmol), pyridine (6 mL) and MsCl (153 µL, 1.97 mmol) analogously to **18**. It was isolated after chromatography (EtOAc/cyclohexane, 4:6). (243 mg, 81%). $[\alpha]_D^{20}$ = +59 (*c* = 1, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 2.14 (s, 3 H, C*H*$_3$), 3.86 (dd, 1 H, *H-5a*), 3.93 (dd, 1 H, H-5b), 4.12 (dd, 1 H, H-7), 4.35 (ddd, 1 H, H-6), 4.52 and 4.59 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 4.62 and 4.68 (AB, J_{gem} = 12.2 Hz, 2 H, CH_2Ph), 4.70 and 4.83 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 4.78 (d, 1 H, *H*-8), 6.85 (s, 1 H, H-2), 7.21–7.37 (m, 15 H, C*H* arom.) ppm; $J_{5a,6}$ = 9.7, $J_{5b,6}$ =

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5.9, $J_{5a,5b}$ = 11.6, $J_{6,7}$ = 1.6, $J_{7,8}$ = 3.8 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 8.9 (*C*H$_3$), 42.5 (*C*-5), 70.1 (*C*-8), 71.5 (*C*H$_2$Ph), 71.6 (*C*H$_2$Ph), 71.9 (*C*-6), 72.4 (*C*H$_2$Ph), 73.7 (*C*-7), 124.9 (*C*-2), 127.4 (*C*-3), 127.6–128.5 (*C*H arom.), 137.5, 137.7, 138.0 (3 × $C_{quat.}$ of phenyls), 141.5 (*C*-8a) ppm.

(2*S*,3*S*,4*S*)-2,3,4-Tris(benzyloxy)-1,2,3,4,6,7,8,9-octahydrobenz[4,5]-imidazo[1,2-*a*]pyridine (20): This compound was prepared from **17** (300 mg, 0.585 mmol), pyridine (10 mL) and MsCl (160 μL, 2.06 mmol) analogously to **18**. It was isolated after chromatography (EtOAc/cyclohexane, 4:6) (270 mg, 93%). $[\alpha]_D^{20}$ = +34 (*c* = 1, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 1.76 (m, 4 H, H-10, H-11), 2.40, 2.58 (2 × m, 4 H, H-9, H-12), 3.82–3.88(m, 2 H, 2 × H-5), 4.13 (dd, 1 H, H-7), 4.33 (ddd, 1 H, H-6), 4.49 and 4.56 (AB, J_{gem} = 11.9 Hz, 2 H, C*H*$_2$Ph), 4.63 and 4.84 (AB, J_{gem} = 12.0 Hz, 2 H, C*H*$_2$Ph), 4.64 and 4.69 (AB, J_{gem} = 12.3 Hz, 2 H, C*H*$_2$Ph), 4.70 (d, 1 H, H-8), 7.21–7.35 (m, 15 H, C*H* arom.) ppm; $J_{5,6}$ = 8.8 and 7.0, $J_{6,7}$ = 1.8, $J_{7,8}$ = 3.7 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 20.0 (C-12), 22.7 and 23.2 (C-10 and C-11), 24.0 (C-9), 42.0 (C-5), 71.0 (C-8), 71.2 (*C*H$_2$Ph), 71.3 (*C*H$_2$Ph), 71.9 (*C*-6), 72.3 (*C*H$_2$Ph), 74.1 (*C*-7), 125.4 (*C*-2), 127.3–128.4 (*C*H of phenyls), 136.6 (*C*-3), 137.6, 137.8, 138.3 (3 × $C_{quat.}$ of phenyls), 139.7 (C-8a) ppm.

(6*S*,7*S*,8*S*)-3-Methyl-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine-6,7,8-triol (21): A solution of **19** (190 mg, 0.418 mmol) in EtOH/AcOH (1:1, 6 mL) was stirred under H_2 (1 bar) at room temperature in the presence of $Pd(OH)_2$/C (150 mg) for 18 h. The suspension was centrifuged and the catalyst rinsed several times with hot MeOH. The combined organic solutions were concentrated to dryness in vacuo. The residue was purified by flash chromatography (EtOAc/MeOH, 6:4) to give **21** (62 mg, 78%) as a colourless syrup. $[\alpha]_D^{20}$ = +25 (*c* = 1, MeOH). ^{1}H NMR (400 MHz, CD_3OD): δ = 2.17 (d, 3 H, C*H*$_3$), 3.75 (dd, 1 H, H-5a), 3.98 (dd, 1 H, H-5b), 3.99 (dd, 1 H, H-7), 4.39 (ddd, 1 H, H-6), 4.68 (d, 1 H, H-8), 6.67 (br. s, 1 H, H-2) ppm; $J_{5a,6}$ = 7.7, $J_{5b,6}$ = 5.2, $J_{5a,5b}$ = 12.1, $J_{6,7}$ = 2.1, $J_{7,8}$ = 4.9 Hz. ^{13}C NMR (100.6 MHz, CD_3OD): δ = 8.8 (*C*H$_3$), 45.5 (*C*-5), 66.5 (*C*-6), 67.9 (*C*-8), 73.9 (*C*-7), 126.2 (*C*-2), 128.5 (*C*-3), 145.6 (*C*-8a) ppm. HR-MS: calcd. for $[M]^+$ ($C_8H_{12}N_2O_3$) 184.0848; found 184.0844.

(2*S*,3*S*,4*S*)-1,2,3,4,6,7,8,9-Octahydrobenz[4,5]imidazo[1,2-*a*]pyridine-2,3,4-triol (22): This compound was prepared from **20** (257 mg, 0.53 mmol), EtOH/AcOH (1:1, 6 mL) and $Pd(OH)_2$/C (200 mg) analogously to **21**. It was isolated as a colourless syrup (84 mg, 72%). $[\alpha]_D^{20}$ = +2.5 (*c* = 1, MeOH). ^{1}H NMR (400 MHz, CD_3OD): δ = 1.88 (m, 4 H, H-10, H-11), 2.61 (m, 4 H, H-9, H-12), 3.98 (dd, 1 H, H-7), 4.00 (dd, 1 H, H-5a), 4.18 (dd, 1 H, H-5b), 4.40 (ddd, 1 H, H-6), 4.87 (d, 1 H, H-8) ppm; $J_{5a,6}$ = 4.8, $J_{5b,6}$ = 4.0, $J_{5a,5b}$ = 13.0, $J_{6,7}$ = 2.1, $J_{7,8}$ = 6.9 Hz. ^{13}C NMR (CD_3OD, 100.6 MHz): δ = 20.1, 21.7 (C-9, C-12), 22.8, 23.0 (C-10, C-11), 48.2 (C-5), 66.3 (C-8), 67.4 (C-6), 73.4 (C-7), 129.4, 130.7 (C-2, C-3), 144.1 (C-8a) ppm. HR-MS: calcd. for $[M + H]^+$ ($C_{11}H_{17}N_2O_3$) 225.1234; found 225.1232.

(2*S*,3*R*,4*S*)-2,3,4-Tris(benzyloxy)-4-(5-iodo-4-methyl-1*H*-imidazol-2-yl)butan-1-ol (23): A solution of **13** (1.387 g, 3.02 mmol) and NIS (1.00 g, 4.50 mmol) in CH_3CN (40 mL) was stirred at room temperature in the dark for 12 h. The reaction mixture was then concentrated in vacuo. The residue was dissolved in EtOAc (90 mL) and an aqueous solution of Na_2S (70 mL) was added and the heterogeneous mixture vigorously stirred for 15 min. The organic phase was extracted and washed twice with brine (2 × 80 mL), dried ($MgSO_4$), filtered and the solvent evaporated in vacuo. The crude product was purified by flash chromatography (EtOAc/cyclohexane, 3:7) to give **23** as a colourless oil (1.468 g, 82%). $[\alpha]_D^{20}$ = +32 (*c* = 1, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 2.03 (s, 3 H, CH_3), 2.20 (br. s, 1 H, OH), 3.76–3.85 (m, 2 H, H-3 H-4a), 3.90 (dd, 1 H, H-2), 3.97 (m, 1 H, H-4b), 4.04 and 4.65 (AB, J_{gem} = 11.1 Hz, 2 H, C*H*$_2$Ph), 4.29 and 4.40 (AB, J_{gem} = 11.8 Hz, 2 H, C*H*$_2$Ph), 4.32 and 4.52 (AB, J_{gem} = 11.4 Hz, 2 H, C*H*$_2$Ph), 4.89 (d, 1 H, H-1), 7.12–7.31 (m, 15 H, C*H* arom.), 9.14 (br. s, 1 H, NH) ppm; $J_{1,2}$ = 2.5, $J_{2,3}$ = 7.6, $J_{4a,4b}$ = 11.6 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 11.2 (CH_3), 59.9 (C-4), 71.7 (*C*H$_2$Ph), 72.0 (*C*H$_2$Ph), 75.1 (C-1), 75.1 (*C*H$_2$Ph), 78.6 (C-3), 80.6 (C-2), 81.7 (*C*-I), 127.5–128.5 (CH of phenyls), 129.4 (*C*-CH$_3$), 137.2, 137.5, 137.8 (3 × $C_{quat.}$ of phenyls), 147.4 (C-2′) ppm. $C_{29}H_{31}IN_2O_4$ (566.44): calcd. C 58.20, H 5.22, I 21.20, N 4.68; found C 57.9, H 5.3, I 20.9, N 4.5.

(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-2-methyl-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine (26) and 19: MsCl (400 μL, 5.2 mmol) was added to a stirred solution of **23** (622 mg, 1.04 mmol) in anhydrous pyridine (20 mL) at 0 °C under argon. After 10 min, the reaction mixture was warmed up slowly to 80 °C, stirred at this temperature for 30 min, cooled to room temperature and then quenched with MeOH. The solvent was evaporated and the residue dissolved in CH_2Cl_2. This solution was washed with H_2O and brine, dried ($MgSO_4$), filtered, concentrated and dried in vacuo. The crude mixture was dissolved in anhydrous THF (20 mL), and treated with EtMgBr (3 M in ether, 1.7 mL, 5.1 mmol) at 0 °C. After 10 min, the reaction was quenched with MeOH (1 mL) and concentrated to dryness. The residue was dissolved in CH_2Cl_2, washed with aqueous NH_4Cl, dried ($MgSO_4$), filtered and the solvent evaporated in vacuo. The residue, which gave **26/19** (83:17) as determined by ^{1}H NMR spectroscopy, was purified by chromatography (EtOAc/cyclohexane, 3:7) to give **26** (255 mg) and a mixture of **26** and **19** (78 mg; overall yield 70%). **26:** $[\alpha]_D^{20}$ = +29 (*c* = 1.0, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 2.21 (s, 3 H, CH_3), 4.01 (dd, 1 H, H-5a), 4.06 (dd, 1 H, H-5b), 4.12 (dd, 1 H, H-7), 4.33 (ddd, 1 H, H-6), 4.51 and 4.58 (AB, J_{gem} = 11.9 Hz, 2 H, C*H*$_2$Ph), 4.62 and 4.86 (AB, J_{gem} = 11.9 Hz, 2 H, C*H*$_2$Ph), 4.65 and 4.68 (AB, J_{gem} = 12.3 Hz, 2 H, C*H*$_2$Ph), 4.66 (d, 1 H, H-8), 6.54 (s, 1 H, H-3), 7.24–7.36 (m, 15 H, C*H* arom.) ppm; $J_{5a,6}$ = 6.3, $J_{5b,6}$ = 9.4, $J_{5a,5b}$ = 11.5, $J_{6,7}$ = 1.9, $J_{7,8}$ = 3.6 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 13.7 (CH_3), 44.2 (C-5), 71.1 (C-8), 71.5 (2 × CH_2Ph), 72.0 (C-6), 72.4 (*C*H$_2$Ph), 74.6 (C-7), 115.5 (C-3), 127.4–128.4 (*C*H arom.), 137.6, 137.9,138.2 (3 × $C_{quat.}$ of phenyls), 138.4 (C-2), 141.4 (C-8a) ppm.

(6*S*,7*S*,8*S*)-2-Methyl-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine-6,7,8-triol (27): This compound was prepared from **26** (229 mg, 0.503 mmol) and EtOH/AcOH (1:1, 8 mL) and $Pd(OH)_2$/C under H_2 analogously to **21**. It was isolated after chromatography (EtOAc/MeOH, 6:4) as a colourless syrup (64 mg, 69%). $[\alpha]_D^{20}$ = +11 (*c* = 1.0, MeOH). ^{1}H NMR (400 MHz, CD_3OD): δ = 2.19 (d, 3 H, CH_3), 3.97 (dd, 1 H, H-5a), 3.98 (dd, 1 H, H-7), 4.12 (dd, 1 H, H-5b), 4.36 (ddd, 1 H, H-6), 4.75 (d, 1 H, H-8), 6.82 (br. s, 1 H, H-3) ppm; $J_{5a,6}$ = 6.5, $J_{5b,6}$ = 4.5, $J_{5a,5b}$ = 12.6, $J_{6,7}$ = 2.1, $J_{7,8}$ = 5.8 Hz. ^{13}C NMR (100.6 MHz, CD_3OD): δ = 12.2 (CH_3), 48.6 (C-5), 67.0 (C-6), 67.3 (C-8), 74.1 (C-7), 117.3 (C-3), 136.9 (C-2), 145.7 (C-8a) ppm. HR-MS: calcd. for $[M + Na]^+$ ($C_8H_{12}N_2O_3Na$)$^+$ 207.0740; found 207.0739.

(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-3-iodo-5,6,7,8-tetrahydroimidazo-[1,2-*a*]pyridine (28) and (6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-2,3-diiodo-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine (29): A solution of **18** (1.554 g, 3.53 mmol) and NIS (1.59 g, 7.06 mmol) in CH_3CN (40 mL) was stirred at 80 °C in the dark for 12 h. More NIS (1.90 g, 8.44 mmol) was then added and the reaction mixture stirred at 80 °C for 12 h. The reaction mixture was then concentrated in vacuo. The residue was dissolved in EtOAc (80 mL), an aqueous

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solution of Na_2S (60 mL) was added, and the heterogeneous mixture vigorously stirred for 15 min. The organic phase was extracted and washed twice with brine (2×80 mL), dried ($MgSO_4$), filtered and the solvent evaporated in vacuo. The residue, which gave a mixture of two products **28**/**29** (82:18) according to ^{1}H NMR spectroscopy, was separated by chromatography (EtOAc/cyclohexane, 1: 9) to afford **28** as a colourless oil (1.137 g, 57%) and **29** (307 mg, 13%, identified below). **28:** $[\alpha]_D^{20}$ = +69 (*c* = 1, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 3.86 (dd, 1 H, H-5a), 4.00 (dd, 1 H, H-5b), 4.13 (dd, 1 H, H-7), 4.34 (ddd, 1 H, H-6), 4.56 and 4.61 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 4.64 and 4.80 (AB, J_{gem} = 12.0 Hz, 2 H, CH_2Ph), 4.65 (d, 1 H, H-8), 4.64 and 4.68 (AB, $J_{gem} \approx$ 13.6 Hz, 2 H, CH_2Ph), 7.16 (s, 1 H, H-2), 7.24–7.38 (m, 15 H, C*H* arom.) ppm; $J_{5a,6}$ = 9.7, $J_{5b,6}$ = 5.8, $J_{5a,5b}$ = 11.7, $J_{6,7}$ = 1.7, $J_{7,8}$ = 3.7 Hz. ^{13}C NMR (100.6, MHz, $CDCl_3$): δ = 45.9 (C-5), 70.1 (C-3), 70.9 (C-8), 71.4 (*C*H_2Ph), 71.8 (*C*H_2Ph), 72.5 (C-6), 72.7 (*C*H_2Ph), 74.7 (C-7), 127.6–128.5 (*C*H arom.), 136.2 (C-2), 137.6, 137.8, 137.9 (3× $C_{quat.}$ of phenyls of benzyls), 145.8 (C-8a) ppm. $C_{28}H_{27}IN_2O_3$ (566.44): calcd. C 59.37, H 4.80, N 4.95; found C 59.2, H 4.8, N 5.0.

(2*S*,3*R*,4*S*)-2,3,4-Tris(benzyloxy)-4-(4,5-diiodo-1*H*-imidazol-2-yl)butan-1-ol (30): This compound was prepared from **12** (2.653 g, 5.78 mmol), CH_3CN (72 mL) and NIS (3.254 g, 14.5 mmol) analogously to **23**. It was isolated after chromatography (EtOAc/cyclohexane, 4:6) as a colourless foam (3.855 g, 94%). $[\alpha]_D^{20}$ = +19 (*c* = 1, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 3.72–3.77 (m, 2 H, H-4a and H-3), 3.86 (dd, 1 H, H-2), 3.92 (dd, 1 H, H-4b), 3.94 and 4.57 (AB, J_{gem} = 10.6 Hz, 2 H, CH_2Ph), 4.26 and 4.38 (AB, J_{gem} = 11.6 Hz, 2 H, CH_2Ph), 4.26 and 4.49 (AB, J_{gem} = 11.5 Hz, 2 H, CH_2Ph), 4.92 (d, 1 H, H-1), 7.02–7.32 (m, 15 H, C*H* arom.) ppm; $J_{1,2}$ = 2.5, $J_{2,3}$ = 7.6, $J_{3,4b}$ = 4.0, $J_{4a,4b} \approx$ 10.5 Hz. ^{13}C NMR (400 MHz, $CDCl_3$): δ = 59.6 (C-4), 71.6 (*C*H_2Ph), 72.4 (*C*H_2Ph), 75.1, 75.2 (*C*H_2Ph and C-1), 78.4 (C-3), 79.9 (C-2), 127.5–128.7 (*C*H arom.), 136.7, 136.9, 137.7 (3× $C_{quat.}$ of phenyls), 152.7 (C-2′) ppm. $C_{28}H_{28}I_2N_2O_4$ (710.36): calcd. C 47.34, H 3.97, N 3.94; found C 47.2, H 4.0,N 4.0.

(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-2,3-diiodo-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine (29): This compound was prepared from **30** (3.295 g, 4.63 mmol), pyridine (68 mL) and MsCl (1.26 mL, 16.23 mmol) analogously to **18**. It was isolated after chromatography (EtOAc/cyclohexane, 2:8) (2.80 g, 87%). $[\alpha]_D^{20}$ = +37 (*c* = 1, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 3.96 (dd, 1 H, H-5a), 4.05 (dd, 1 H, H-5b), 4.17 (dd, 1 H, H-7), 4.39 (ddd, 1 H, H-6), 4.61 and 4.66 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 4.69 and 4.88 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 4.71 and 4.73 (AB, $J_{gem} \approx$ 12.9 Hz, 2 H, CH_2Ph), 4.73 (d, 1 H, H-8), 7.19–7.58 (m, 15 H, CH phenyls) ppm; $J_{5a,6}$ = 9.9, $J_{5b,6}$ = 6.0, $J_{5a,5b}$ = 11.7, $J_{6,7}$ = 1.5, $J_{7,8}$ = 3.4 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 47.2 (C-5), 70.8 (C-8), 71.6 (*C*H_2Ph), 71.8 (*C*H_2Ph), 72.2 (C-6), 72.7 (*C*H_2Ph), 74.2 (C-7), 82.6 (C-3), 95.35 (C-2), 127.6–128.5 (*C*H arom.), 137.4, 137.5, 137.6 (3× $C_{quat.}$ of phenyls), 148.0 (C-8a) ppm.

(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-2-iodo-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine (31): A solution of EtMgBr (3 M in Et_2O, 265 µL, 0.79 mmol) was added dropwise to a stirred solution of **29** (500 mg, 0.72 mmol) in anhydrous CH_2Cl_2 (10 mL) at 0 °C. After 10 min, the reaction mixture was warmed up to room temperature. After 30 min, it was quenched with a concd. solution of NH_4Cl (15 mL). The organic phase was extracted with CH_2Cl_2, dried ($MgSO_4$), filtered and concentrated in vacuo. The residue was purified by flash chromatography (EtOAc/cyclohexane, 3:7) to give **31** (355 mg, 87%) as a slightly yellow oil. $[\alpha]_D^{20}$ = +15 (*c* = 1.0, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 4.05 (dd, 1 H, H-5a), 4.11 (dd, 1 H, H-5b), 4.15 (dd, 1 H, H-7), 4.34 (ddd, 1 H, H-6), 4.55 and 4.62 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 4.69 and 4.89 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 4.68 and 4.70 (AB, J_{gem} = 12.5 Hz, 2 H, CH_2Ph), 4.73 (d, 1 H, H-8), 6.9 (s, 1 H, H-3), 7.24–7.40 (m, 15 H, C*H* arom.) ppm; $J_{5a,6}$ = 6.1, $J_{5b,6}$ = 9.3, $J_{5a,5b}$ = 11.7, $J_{6,7}$ = 1.5, $J_{7,8}$ = 3.8 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 44.4 (C-5), 70.5 (C-8), 71.4 (*C*H_2Ph), 71.5 (C-6), 71.6 (*C*H_2Ph), 72.5 (*C*H_2Ph), 74.6 (C-7), 82.2 (C-2), 124.5 (C-3), 126.9–128.9 (*C*H arom.), 137.4, 137.5, 137.8 (3× $C_{quat.}$ of phenyls), 144.6 (C-8a) ppm. $C_{28}H_{27}IN_2O_3$ (566.44): calcd. C 59.37, H 4.80, N 4.95; found C 59.4, H 4.8, N 5.1.

(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine-3-carbaldehyde (32): EtMgBr (3 M in Et_2O, 102 µL, 0.30 mmol) was added dropwise to a stirred solution of **28** (133 mg, 0.234 mmol) in anhydrous THF (4 mL) at 0 °C. After 20 min, DMF (1 mL, excess) was added. The reaction mixture was warmed up to room temperature, stirred for 2 h, hydrolysed with aqueous NH_4Cl and concentrated in vacuo. The residue was dissolved in CH_2Cl_2 and the solution washed with aqueous NH_4Cl. The organic phase was extracted, dried ($MgSO_4$), filtered and concentrated in vacuo. The crude product was purified by flash chromatography (EtOAc/cyclohexane, 3:7) to give **32** (55 mg, 50%) as a colourless oil. $[\alpha]_D^{20}$ = +103 (*c* = 1, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 4.08 (dd, 1 H, H-7), 4.27 (ddd, 1 H, H-6), 4.35 (dd, 1 H, H-5a), 4.61 (ddd, 1 H, H-5b), 4.62 (s, 2 H, CH_2Ph), 4.66 and 4.70 (AB, J_{gem} = 12.1 Hz, 2 H, CH_2Ph), 4.73 and 4.91 (AB, J_{gem} = 11.8 Hz, 2 H, CH_2Ph), 4.74 (d, 1 H, H-8), 7.25–7.37 (m, 15 H, C*H* arom.), 7.79 (s, 1 H, H-2), 9.72 (s, 1 H, C*H*O) ppm; $J_{5a,6}$ = 8.5, $J_{5b,6}$ = 4.9, $J_{5a,5b}$ = 13.1, $J_{6,7}$ = 1.6, $J_{7,8}$ = 4.3 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 45.5 (C-5), 71.5 (C-8), 71.7 (C-6), 71.8 (*C*H_2Ph), 72.4 (*C*H_2Ph), 72.9 (*C*H_2Ph), 75.0 (C-7), 127.7–128.5 (*C*H arom.), 131.3 (C-3), 137.5, and 137.6, 137.7 (3× $C_{quat.}$ of phenyls), 143.0 (C-2), 149.4 (C-8a), 179.3 (*C*HO) ppm. HR-MS: calcd. for $[M + H]^+$ ($C_{29}H_{29}N_2O_4$) 469.2127; found 469.2131.

(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine-2-carbaldehyde (33): Compound **33** was prepared from **31** (333 mg, 0.59 mmol), THF (4 mL), EtMgBr in Et_2O (236 µL, 0.70 mmol) and DMF (1 mL, excess) analogously to **32**. It was isolated after chromatography (EtOAc/cyclohexane, 4:6) (230 mg, 84%) as a colourless oil. $[\alpha]_D^{20}$ = +26 (*c* = 1, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 4.13 (dd, 1 H, H-5a), 4.14 (dd, 1 H, H-7), 4.18 (dd, 1 H, H-5b), 4.36 (ddd, 1 H, H-6), 4.54 and 4.62 (AB, J_{gem} = 11.8 Hz, 2 H, CH_2Ph), 4.66 (s, 2 H, CH_2Ph) 4.68 and 4.86 (AB, J_{gem} = 11.8 Hz, 2 H, CH_2Ph), 4.71 (d, 1 H, H-8), 7.24–7.38 (m, 15 H, C*H* arom.), 7.52 (s, 1 H, H-3), 9.87 (s, 1 H, CHO) ppm; $J_{5a,6}$ = 6.3, $J_{5b,6}$ = 9.0, $J_{5a,5b}$ = 11.8, $J_{6,7}$ = 1.8, $J_{7,8}$ = 4.0 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 45.2 (C-5), 70.8 (C-8), 71.6 (C-6), 71.7 (*C*H_2Ph), 71.9 (*C*H_2Ph), 72.8 (*C*H_2Ph), 74.6 (C-7), 124.7 (C-3), 127.7–128.6 (*C*H arom.), 137.4, 137.5, 137.6 (3× $C_{quat.}$ of phenyls), 142.2 (C-2), 144.7 (C-8a), 186.0 (C-9) ppm.

(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-2-iodo-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine-3-carbaldehyde (34): This compound was prepared from **29** (690 mg, 0.99 mmol), THF (7 mL), EtMgBr (3 M in Et_2O, 366 µL, 1.09 mmol) and DMF (2 mL, excess) analogously to **32**. It was isolated after chromatography (EtOAc/cyclohexane, 2:8) (522 mg, 88%) as a colourless oil. $[\alpha]_D^{20}$ = +60 (*c* = 1, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 4.04 (dd, 1 H, H-7), 4.23 (ddd, 1 H, H-6), 4.30 (dd, 1 H, H-5a), 4.58 (s, 2 H, CH_2Ph), 4.60 (dd, 1 H, H-5b), 4.63 and 4.67 (AB, J_{gem} = 12.5 Hz, 2 H, CH_2Ph), 4.69 (d, 1 H, H-8), 4.68 and 4.89 (AB, J_{gem} = 11.8 Hz, 2 H, CH_2Ph), 7.22–7.35 (m, 15 H, C*H* arom.), 9.58 (s, 1 H, C*H*O) ppm; $J_{5a,6}$ = 8.8, $J_{5b,6}$ = 4.8, $J_{5a,5b}$ = 13.2, $J_{6,7}$ = 1.5, $J_{7,8}$ = 4.3 Hz. ^{13}C NMR

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(100.6 MHz, $CDCl_3$): δ = 45.2 (C-5), 71.2 (C-6), 71.3 (C-8), 71.7 (*C*H_2Ph), 72.5 (*C*H_2Ph), 72.9 (*C*H_2Ph), 74.5 (C-7), 100.4 (C-2), 127.7–128.5 (*C*H arom.), 129.4 (C-3), 137.3, 137.4, 137.4 (3 × $C_{quat.}$ of phenyls), 150.5 (C-8a), 180.9 (C-9) ppm.

{(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-5,6,7,8-tetrahydroimidazo[1,2-*a*]-pyridin-3-yl}methanol (35): $LiAlH_4$ (4 mg, 0.11 mmol) was added under argon to a stirred solution of **32** (33 mg, 0.07 mmol) in THF at –78 °C. After 1.5 h at –30 °C, the reaction was quenched with MeOH/CH_2Cl_2 and concentrated in vacuo. The residue was dissolved in CH_2Cl_2 and washed with a solution of NH_4Cl. The organic phase was dried ($MgSO_4$), filtered and concentrated in vacuo. The crude product was purified by flash chromatography (CH_2Cl_2/MeOH, 95:5) to afford **35** (28 mg, 85%) as a colourless oil. $[\alpha]_D^{20}$ = +24 (*c* = 1, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 3.99 (dd, 1 H, H-5a), 4.03 (dd, 1 H, H-7), 4.14 (dd, 1 H, H-5b), 4.26 (ddd, 1 H, H-6), 4.46 (s, 2 H, C*H*$_2$ OH), 4.48 and 4.53 (AB, J_{gem} = 12.0 Hz, 2 H, C*H*$_2$Ph), 4.59 (s, 2 H, C*H*$_2$Ph), 4.62 (d, 1 H, H-8), 4.60 and 4.77 (AB, J_{gem} = 12.1 Hz, 2 H, C*H*$_2$Ph), 6.81 (s, 1 H, H-2), 7.18–7.29 (m, 15 H, C*H* arom.) ppm; $J_{5a,6}$ = 9.4, $J_{5b,6}$ = 5.6, $J_{5a,5b}$ = 11.9, $J_{6,7}$ = 1.8, $J_{7,8}$ = 4.0 Hz.

{(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-5,6,7,8-tetrahydroimidazo[1,2-*a*]-pyridin-2-yl}methanol (36): Compound **36** was prepared from **33** (230 mg, 0.49 mmol), THF (5 mL) and $LiAlH_4$ (28 mg, 0.73 mmol) analogously to **35**. It was isolated after chromatography (CH_2Cl_2/MeOH, 95:5) as a colourless oil (191 mg, 83%). $[\alpha]_D^{20}$ = +31 (*c* = 1, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 3.76 (dd, 1 H, H-5a), 3.91 (dd, 1 H, H-5b), 3.98 (dd, 1 H, H-7), 4.11 (ddd, 1 H, H-6), 4.37 and 4.44 (AB, J_{gem} = 11.9 Hz, 2 H, C*H*$_2$Ph), 4.44 and 4.51 (AB, J_{gem} = 11.8 Hz, 2 H, C*H*$_2$Ph), 4.52 and 4.56 (AB, J_{gem} = 12.3 Hz, 2 H, C*H*$_2$Ph), 4.47 and 4.56 (AB, 2 H, C*H*$_2$OH, J_{gem} ≈ 13 Hz), 4.57 (d, 1 H, H-8), 5.16 (br. s, 1 H, OH), 6.64 (s, 1 H, H-3), 7.10–7.27 (m, 15 H, CH phenyls) ppm; $J_{5a,6}$ = 5.8, $J_{5b,6}$ = 9.8, $J_{5a,5b}$ = 11.5, $J_{6,7}$ = 1.8, $J_{7,8}$ = 3.7 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 44.4 (C-5), 58.1 (*C*H_2OH), 70.9 (C-8), 71.6 (2 *C*H_2Ph), 71.9 (C-6), 72.4 (*C*H_2Ph), 74.7 (C-7), 116.4 (C-3), 127.4–128.4 (*C*H arom.), 137.7, 137.8, 138.2 (3 × $C_{quat.}$ of phenyls), 142.2, 142.5 (C-8a and C-2) ppm. HR-MS: calcd. for $[M + H]^+$ ($C_{29}H_{31}N_2O_4$) 471.2284; found 471.2285.

{(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-2-iodo-5,6,7,8-tetrahydroimidazo-[1,2-*a*]pyridin-3-yl}methanol (37): Compound **37** was prepared from **34** (200 mg, 0.34 mmol), THF (4 mL) and $LiAlH_4$ (19 mg, 0.73 mmol) analogously to **35**. It was isolated after chromatography (EtOAc/cyclohexane, 3:7) (137 mg, 68%). $[\alpha]_D^{20}$ = +24 (*c* = 1, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 4.04 (dd, 1 H, H-7), 4.12 (dd, 1 H, H-5a), 4.28–4.34 (m, 2 H, H-6 and H-5b), 4.51 (s, 2 H, C*H*$_2$OH), 4.55 (s, 2 H, C*H*$_2$Ph), 4.62 (s, 2 H, C*H*$_2$Ph), 4.66 and 4.84 (AB, J_{gem} = 11.8 Hz, 2 H, C*H*$_2$Ph), 4.76 (dd, 1 H, H-8), 7.24–7.35 (m, 15 H, C*H* arom.) ppm; $J_{5a,6}$ = 11.0, $J_{5a,5b}$ = 13.8, $J_{6,7}$ = 1.3, $J_{7,8}$ = 4.0 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 43.6 (C-5), 54.5 (*C*H_2OH), 70.6 (C-8), 71.5, 71.7 (C-6 and *C*H_2Ph), 72.2 (*C*H_2Ph), 72.7 (*C*H_2Ph), 74.2 (C-7), 82.7 (C-2), 127.7–128.5 (*C*H arom.), 133.3 (C-3), 137.4, 137.5, 137.6 (3 × $C_{quat.}$ of phenyls), 145.5 (C-8a) ppm. HR-MS: calcd. for $[M + H]^+$ ($C_{29}H_{30}IN_2O_4$) 597.1250; found 597.1250.

(6*S*,7*S*,8*S*)-3-(Hydroxymethyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine-6,7,8-triol (38): A solution of **35** (60 mg, 0.127 mmol) in EtOH/AcOH (1:1, 2 mL) was stirred under H_2 (1 bar) at room temperature in the presence of $Pd(OH)_2$/C (53 mg) for 12 h. The suspension was centrifuged and the catalyst rinsed several times with hot MeOH. The combined organic solutions were concentrated to dryness in vacuo. The residue, dissolved in MeOH, was purified on an ion-exchange column (IRA, 400, OH^-, MeOH). After concentration in vacuo, the crude product was purified by chromatography (CH_2Cl_2/MeOH/MeOH–NH_3, 6:3:1) to afford **38** (22 mg, 87%) as a colourless oil. $[\alpha]_{578}^{20}$ = +21 (*c* = 0.9, MeOH), $[\alpha]_{546}^{20}$ = +24 (*c* = 0.9, MeOH). ^{1}H NMR (400 MHz, CD_3OD): δ = 3.98 (dd, 1 H, H-5a), 3.99 (dd, 1 H, H-7), 4.18 (dd, 1 H, H-5b), 4.39 (ddd, 1 H, H-6), 4.56 (s, 2 H, C*H*$_2$OH), 4.71 (d, 1 H, H-8), 6.97 (s, 1 H, H-2) ppm; $J_{5a,6}$ = 7.4, $J_{5b,6}$ = 5.0, $J_{5a,5b}$ = 12.5, $J_{6,7}$ = 2.1, $J_{7,8}$ = 5.2 Hz. ^{13}C NMR (100.6 MHz, CD_3OD): δ = 46.3 (C-5), 54.1 (*C*H_2OH), 66.6 (C-6), 67.8 (C-8), 73.9 (C-7), 127.5 (C-2), 132.3 (C-3), 147.3 (C-8a) ppm. HR-MS: calcd. for $[M]^+$ ($C_8H_{12}N_2O_4$) 200.0797; found 200.0792.

(6*S*,7*S*,8*S*)-2-(Hydroxymethyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine-6,7,8-triol (39): Compound **39** was prepared from **36** (90 mg, 0.53 mmol), EtOH/AcOH (1:1, 4 mL), H_2 and $Pd(OH)_2$/C (97 mg) analogously to **38**. It was isolated as a colourless oil (26 mg, 68%). $[\alpha]_D^{20}$ = +11 (*c* = 1, MeOH). ^{1}H NMR (400 MHz, CD_3OD): δ = 3.95 (dd, 1 H, H-5a), 3.98 (dd, 1 H, H-7), 4.11 (dd, 1 H, H-5b), 4.36 (ddd, 1 H, H-6), 4.49 (s, 2 H, C*H*$_2$OH), 4.69 (d, 1 H, H-8), 6.94 (s, 1 H, H-3) ppm; $J_{5a,6}$ = 7.3, $J_{5b,6}$ = 4.9, $J_{5a,5b}$ = 12.4, $J_{6,7}$ = 2.1, $J_{7,8}$ = 5.1 Hz. ^{13}C NMR (100.6 MHz, CD_3OD): δ = 47.9 (C-5), 58.7 (*C*H_2OH), 66.7 (C-6), 67.8 (C-8), 74.3 (C-7), 117.7 (C-3), 143.0, 147.0 (C-2, C-8a) ppm. HR-MS: calcd. for $[M]^+$ ($C_8H_{12}N_2O_4$) 200.0797; found 200.0793.

Phenyl{(6*S*,7*S*,8*S*)-6,7,8-tris(benzyloxy)-5,6,7,8-tetrahydroimidazo-[1,2-*a*]pyridin-3-yl}methanone (40): BnMgBr (2 M in Et_2O, 441 μL, 0.88 mmol) was added dropwise to a stirred solution of **28** (100 mg, 0.18 mmol) in anhydrous THF (2 mL) at 0 °C. After 20 min, benzaldehyde (1 mL, 9.8 mmol) was added. The reaction mixture was warmed up to room temperature, stirred for 48 h, hydrolysed with an aqueous solution of NH_4Cl and the THF evaporated in vacuo. The residue was dissolved in CH_2Cl_2 and H_2O. The organic phase was extracted, dried ($MgSO_4$), filtered and concentrated in vacuo. The crude product was purified by flash chromatography (EtOAc/cyclohexane, 2:8) to give **40** (92 mg, 84%) as a colourless oil. $[\alpha]_D^{20}$ = +64 (*c* = 1, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 4.11 (dd, 1 H, H-7), 4.32 (ddd, 1 H, H-6), 4.49 (dd, 1 H, H-5a), 4.63 and 4.66 (AB, J_{gem} = 12.1 Hz, 2 H, C*H*$_2$Ph), 4.72 (dd, 1 H, H-5b), 4.70 and 4.73 (AB, J_{gem} = 12.1 Hz, 2 H, C*H*$_2$Ph), 4.75 and 4.95 (AB, J_{gem} = 11.8 Hz, 2 H, C*H*$_2$Ph), 4.78 (d, 1 H, H-8), 7.25–7.37, 7.47–7.50, 7.57–7.60, 7.82–7.84 (m, 20 H, C*H* arom.), 7.60 (s, 1 H, H-2) ppm; $J_{5a,6}$ = 8.7, $J_{5b,6}$ = 5.2, $J_{5a,5b}$ = 13.4, $J_{6,7}$ = 1.7, $J_{7,8}$ = 4.4 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 45.7 (C-5), 71.8, 71.8 (*C*H_2Ph and C-8), 71.9 (C-6), 72.4 (*C*H_2Ph), 72.9 (*C*H_2Ph), 75.0 (C-7), 127.7- 129.9 (*C*H arom. and C-3), 132.4 (*C*H of phenyl), 137.7, 137.8, 137.8, 138.8, (4 × $C_{quat.}$ of phenyls), 140.9 (C-2), 148.7 (C-8a), 185.5 (*C*OPh) ppm. HR-MS: calcd. for $[M + H]^+$ ($C_{35}H_{33}N_2O_4$) 545.2440; found 545.2433.

Phenyl{(6*S*,7*S*,8*S*)-6,7,8-tris(benzyloxy)-5,6,7,8-tetrahydroimidazo-[1,2-*a*]pyridin-2-yl}methanol (42) and Phenyl{(6*S*,7*S*,8*S*)-6,7,8-tris-(benzyloxy)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridin-2-yl}methanone (43): EtMgBr (3 M in Et_2O, 110 μL, 0.32 mmol) was added dropwise to a stirred solution of **31** (154 mg, 0.272 mmol) in anhydrous THF (2 mL) at 0 °C. After 20 min, benzaldehyde (290 μL, 2.84 mmol) was added. The reaction mixture was warmed up to room temperature. It was then stirred for 3 h, hydrolysed with an aqueous solution of NH_4Cl and the THF evaporated in vacuo. The residue was dissolved in CH_2Cl_2 and H_2O. The organic phase was extracted, dried ($MgSO_4$), filtered and concentrated in vacuo. The crude product was purified by flash chromatography (EtOAc/cyclohexane, 2:8) to give **43** (39 mg, 0.07 mmol) as a colourless oil and a mixture of **42** and **43** (105 mg, 0.19 mmol) with a global yield of 97%. This mixture was used directly for the next reaction (see **44**

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below). **43:** $[\alpha]_D^{20}$ = +27 (*c* = 1.0, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ = 4.11 (dd, 1 H, H-5a), 4.15 (dd, 1 H, H-7), 4.16 (dd, 1 H, H-5b), 4.37 (ddd, 1 H, H-6), 4.53 and 4.61 (AB, J_{gem} = 12.0 Hz, 2 H, CH_2Ph), 4.64 and 4.67 (AB, J_{gem} = 12.4 Hz, 2 H, CH_2Ph), 4.72 and 4.90 (AB, J_{gem} = 12.0 Hz, 2 H, CH_2Ph), 4.78 (d, 1 H, H-8), 7.22–7.56 (m, 18 H, C*H* of phenyls), 7.55 (s, 1 H, H-3), 8.18 (d, 2 H, H arom.) ppm; $J_{5a,6}$ = 6.4, $J_{5b,6}$ = 9.4, $J_{5a,5b}$ = 11.9, $J_{6,7}$ = 1.4, $J_{7,8}$ = 4.0 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 45.0 (C-5), 70.6 (C-8), 71.6, 71.7 71.8 (C-6 and 2× CH_2Ph), 72.6 (CH_2Ph), 74.7 (C-7), 126.5–130.1 (C-3 and *C*H arom.), 132.1 (*C*H of phenyl), 137.4, 137.4, 137.6, 138.0 (4× $C_{quat.}$ of phenyls), 141.5, 143.6 (C-8a and C-2), 187.8 (*C*OPh) ppm.

(6*S*,7*S*,8*S*)-3-Benzyl-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine-6,7,8-triol (41): This compound was prepared from **40** (81 mg, 0.148 mmol), EtOH/AcOH (1:1, 2 mL) and $Pd(OH)_2$/C (80 mg) under H_2 analogously to **21**. It was isolated after chromatography (CH_2Cl_2/MeOH/MeOH–NH_3, 6:3.5:0.5) as a colourless oil (23 mg, 60%). $[\alpha]_{578}^{20}$ = +8.0 (*c* = 1.0, MeOH), $[\alpha]_{546}^{20}$ = +8.2 (*c* = 1.0, MeOH). ^1H NMR (400 MHz, CD_3OD): δ = 3.66 (dd, 1 H, H-5a), 3.86 (dd, 1 H, H-5b), 3.94 (dd, 1 H, H-7), 3.96 (s, 2 H, CH_2Ph), 4.3 (ddd, 1 H, H-6), 4.70 (d, 1 H, H-8), 6.79 (s, 1 H, H-2), 7.18–7.31 (m, 5 H, CH arom.) ppm; $J_{5a,6}$ = 7.6, $J_{5b,6}$ = 5.2, $J_{5a,5b}$ = 12.0, $J_{6,7}$ = 2.1, $J_{7,8}$ = 5.2 Hz. ^{13}C NMR (100.6 MHz, CD_3OD): δ = 30.8 (CH_2Ph), 46.1 (C-5), 66.4 (C-6), 67.8 (C-8), 73.8 (C-7), 126.8 (C-2), 127.7, 129.6, 129.7 (*C*H of phenyls), 131.9 (C-3), 139.0 ($C_{quat.}$ of phenyls), 146.4 (C-8a) ppm. HR-MS: calcd. for $[M]^+$ ($C_{14}H_{16}N_2O_3$) 260.1161; found 260.1167.

(6*S*,7*S*,8*S*)-2-Benzyl-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine-6,7,8-triol (44): This compound was prepared from the mixture **42** + **43** (86 mg, 0.158 mmol) and EtOH/AcOH (1:1, 2 mL) and $Pd(OH)_2$/C (90 mg) under H_2 analogously to **21**. It was isolated after chromatography (CH_2Cl_2/MeOH/MeOH–NH_3, 6:3.5:0.5) as a colourless oil (30 mg, 73%). $[\alpha]_D^{20}$ = +3 (*c* = 1, MeOH). ^1H NMR (400 MHz, CD_3OD): δ = 3.83 (s, 2 H, CH_2Ph), 3.89 (dd, 1 H, H-5a), 3.97 (dd, 1 H, H-7), 4.05 (dd, 1 H, H-5b), 4.34 (ddd, 1 H, H-6), 4.67 (d, 1 H, H-8), 6.63 (s, 1 H, H-3) 7.13–7.23 (m, 5 H, H arom.) ppm; $J_{5a,6}$ = 7.6, $J_{5b,6}$ = 5.0, $J_{5a,5b}$ = 12.3, $J_{6,7}$ = 2.1, $J_{7,8}$ = 5.0 Hz. ^{13}C NMR (100.6 MHz, CD_3OD): δ = 35.3 (CH_2Ph), 47.6 (C-5), 66.5 (C-6), 67.8 (C-8), 74.4 (C-7), 117.2 (C-3), 127.1, 129.3, 129.8 (*C*H of phenyl), 141.5, 143.0 145.9 ($C_{quat.}$ of phenyl, C-2, C-8a) ppm. HR-MS: calcd. for $[M]^+$ ($C_{14}H_{16}N_2O_3$) 260.1161; found 260.1155.

(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-3-(phenylethynyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine (45): Phenylacetylene (224 μL, 2.04 mmol), NEt_3 (340 μL, 2.45 mmol), $[Pd(PPh_3)_4]$ (32 mg, 0.20 mmol) and copper(I) iodide (8 mg, 0.04 mmol) were added to a solution of **28** (231 mg, 0.41 mmol) in DMF (8 mL). The mixture was heated at 80 °C whilst stirring under argon for 3 h and concentrated in vacuo. The residue was purified by chromatography (EtOAc/cyclohexane, 1:9) to afford **45** (204 mg, 92%) as a yellowish oil. $[\alpha]_D^{20}$ = +81 (*c* = 1, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ = 4.07 (dd, 1 H, H-5a), 4.14 (dd, 1 H, H-7), 4.21 (dd, 1 H, H-5b), 4.36 (ddd, 1 H, H-6), 4.56 and 4.63 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 4.69 and 4.86 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 4.68 (s, 2 H, CH_2Ph), 4.71 (d, 1 H, H-8), 7.24–7.35, 7.47–7.49 (m, 21 H, C*H* arom. and H-2) ppm; $J_{5a,6}$ = 9.6, $J_{5b,6}$ = 5.7, $J_{5a,5b}$ = 12.1, $J_{6,7}$ = 1.6, $J_{7,8}$ = 3.7 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 43.3 (C-5), 70.8 (C-8), 71.5 (CH_2Ph), 71.8 (CH_2Ph), 72.3 (C-6), 72.6 (CH_2Ph), 74.7 (C-7), 77.0 (*C*CPh), 96.5 (C*C*Ph), 115.3 (C-3), 122.5 ($C_{quat.}$ of phenyl), 127.6–128.5, 131.3 (*C*H of phenyls), 134.1 (C-2), 137.6, 137.8, 137.9 (3× $C_{quat.}$ of phenyls), 143.5 (C-8a) ppm. HR-MS: calcd. for $[M]^+$ ($C_{36}H_{32}N_2O_3$) 540.2413; found 540.2416.

(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-2-(phenylethynyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine (46): This compound was prepared from a solution of **31** (200 mg, 0.353 mmol) in DMF (6 mL) and phenylacetylene (178 μL, 1.62 mL), NEt_3 (225 μL, 1.62 mmol), $[Pd(PPh_3)_4]$ (25 mg, 0.16 mmol) and CuI (7 mg, 0.04 mmol) by heating for 12 h analogously to **45**. It was isolated after chromatography (EtOAc/cyclohexane, 1:9) as a brownish oil (143 mg, 75%). $[\alpha]_D^{20}$ = –8 (*c* = 1, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ = 4.07 (dd, 1 H, H-5a), 4.12 (dd, 1 H, H-5b), 4.14 (dd, 1 H, H-7), 4.37 (ddd, 1 H, H-6), 4.54 and 4.61 (AB, 2 H, CH_2Ph, J_{gem} = 11.9), 4.66 (s, 2 H, CH_2Ph), 4.68 and 4.87 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 4.70 (d, 1 H, H-8), 7.08 (s, 1 H, H-3), 7.24–7.40, 7.50–7.53 (m, 20 H, C*H* arom.) ppm; $J_{5a,6}$ = 6.5, $J_{5b,6}$ = 9.1, $J_{5a,5b}$ = 11.6, $J_{6,7}$ = 1.7, $J_{7,8}$ = 3.7 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 44.7 (C-5), 70.7 (C-8), 71.6 (CH_2Ph), 71.7 (CH_2Ph), 71.8 (C-6), 72.6 (CH_2Ph), 74.7 (C-7), 83.1, 89.3 (*CC*Ph), 123.0 (C-3), 123.3, 124.5 (C-2 and $C_{quat.}$ of phenyl), 127.7–128.5 and 131.5 (*C*H of phenyls), 137.5, 137.7, 138.0 (3× $C_{quat.}$ of phenyls), 142.9 (C-8a) ppm. HR-MS: calcd. for $[M]^+$ ($C_{36}H_{32}N_2O_3$) 540.2413; found 540.2410.

(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-2-(3-phenylprop-1-ynyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine (47): This compound was prepared from a solution of **31** (342 mg, 0.604 mmol) in DMF (3 mL) and 3-phenyl-1-propyne (420 μL, 3.02 mmol), NEt_3 (420 μL, 3.02 mmol), $[Pd(PPh_3)_4]$ (47 mg, 0.302 mmol) and CuI (23 mg, 0.12 mmol) by heating for 12 h analogously to **45**. It was isolated after chromatography (EtOAc/cyclohexane, 2:8) as a brownish oil (252 mg, 75%). $[\alpha]_{546}^{20}$ = +50 (*c* = 1, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ = 3.81 (s, 2 H, CCCH_2Ph), 3.85–3.96 (m, 2 H, H-5a, H-6), 4.07–4.14 (m, 2 H, H-5b, H-7), 4.54 and 4.73 (AB, J_{gem} = 11.8 Hz, 2 H, CH_2Ph), 4.60 and 4.70 (AB, J_{gem} = 11.4 Hz, 2 H, CH_2Ph), 4.71 (broad signal, 1 H, H-8), 4.82 and 5.12 (AB, J_{gem} = 11.7 Hz, 2 H, CH_2Ph), 6.93 (s, 1 H, H-3), 7.19–7.8 (m, 20 H, C*H* arom.) ppm. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 25.8 (CC*C*H_2Ph), 46.2 (C-5), 71.8, 71.9, 72.1, 73.2 (C-8, 3× CH_2Ph), 74.1 (C-6), 79.1 (C-7), 87.6 (*C*CCH$_2$Ph), 121.9 (C-3), 124.5 (C*C*CH$_2$Ph), 127.4–128.6, 128.9 (*C*H of phenyl, C-2), 136.6, 137.5, 137.6, 138.2 (4× $C_{quat.}$ of phenyls), 143.3 (C-8a) ppm.

(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-3-(cyclohex-1-enylethynyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine (48): This compound was prepared from a solution of **28** (316 mg, 0.56 mmol) in DMF (11 mL) and ethynylcyclohexene (330 μL, 2.80 mmol), NEt_3 (390 μL, 2.80 mmol), $[Pd(PPh_3)_4]$ (44 mg, 0.28 mmol) and CuI (11 mg, 0.06 mmol) by heating for 12 h analogously to **45**. It was isolated after chromatography (EtOAc/cyclohexane, 1:9) as a brownish oil (274 mg, 94%) and used directly for the next step. $[\alpha]_D^{20}$ = +76 (*c* = 1, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ = 1.60–1.70 (m, 4 H, CH_2 cyclohexene), 2.15 (m, 4 H, CH_2 cyclohexene), 3.99 (dd, 1 H, H-5a), 4.12 (dd, 1 H, H-7), 4.13 (dd, 1 H, H-5b), 4.33 (ddd, 1 H, H-6), 4.57 and 4.62 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 4.66 and 4.83 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 4.66 (s, 2 H, CH_2Ph), 4.68 (d, 1 H, H-8), 6.19 (m, 1 H, H-2′), 7.23–7.37 (m, 16 H, H-2 and C*H* arom.) ppm; $J_{5a,6}$ = 9.7, $J_{5b,6}$ = 5.7, $J_{5a,5b}$ = 12.1, $J_{6,7}$ = 1.8, $J_{7,8}$ = 3.9 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 21.4, 22.2, 25.7, 29.0 (*C*H$_2$ of cyclohexene), 43.2 (C-5), 70.8 (C-8), 71.5 (CH_2Ph), 71.7 (CH_2Ph), 72.3 (C-6), 72.6 (CH_2Ph), 74.2 (*C*C-cyclohex.), 74.7 (C-7), 98.3 (C*C*-cyclohex.), 115.8 (C-1′), 120.2 (C-3), 127.6–128.5 (*C*H of phenyls), 133.3 (C-2), 135.7 (C-2′), 137.7, 137.8, 137.9 ($C_{quat.}$ of phenyls), 143.0 (C-8a) ppm.

(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-2-(cyclohex-1-enylethynyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine (49): This compound was prepared from a solution of **31** (347 mg, 0.61 mmol) in DMF (12 mL) and 1-ethynylcyclohexene (360 μL, 3.06 mmol), NEt_3 (430 μL, 3.1 mmol),

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$[Pd(PPh_3)_4]$ (48 mg, 0.30 mmol) and CuI (12 mg, 0.06 mmol) by heating for 12 h analogously to **45**. It was isolated after chromatography (EtOAc/cyclohexane, 1:9) as a brownish oil (299 mg, quant.) and used directly for the next step. $[\alpha]_D^{20} = -24$ (c = 1, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ = 1.50–1.65 (m, 4 H, CH_2 of cyclohexene), 2.1 (m, 2 H, CH_2 of cyclohexene), 2.2 (m, 2 H, CH_2 of cyclohexene), 4.00 (dd, 1 H, H-5a), 4.05 (dd, 1 H, H-5b), 4.11 (dd, 1 H, H-7), 4.32 (ddd, 1 H, H-6), 4.50 and 4.56 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 4.61 and 4.64 (AB, J_{gem} = 12.5 Hz, 2 H, CH_2Ph), 4.67 (d, 1 H, H-8), 4.65 and 4.85 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 6.17 (m, 1 H, H-2′), 6.94 (s, 1 H, H-3), 7.21–7.34 (m, 15 H, CH arom.) ppm; $J_{5a,6}$ = 6.4, $J_{5b,6}$ = 8.5, $J_{5a,5b}$ = 11.7, $J_{6,7}$ = 1.5, $J_{7,8}$ = 3.6 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 21.4, 22.2, 25.6, 28.9 (CH_2 of cyclohexene), 44.5 (C-5), 70.5 (C-8), 71.4, 71.5, 71.7, 72.3 (3 × CH_2Ph, C-6), 74.7 (C-7), 80.2, 90.9 (*C*C-cyclohex.), 120.5 (C-1′), 122.2 (C-3), 124.7 (C-2), 127.4–128.3 (CH of phenyls), 134.6 (C-2′), 137.5, 137.6, 137.9 ($C_{quat.}$ of phenyls), 142.4 (C-8a) ppm.

(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-3-(pyridin-2-ylethynyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine (50): This compound was prepared from a solution of **28** (222 mg, 0.39 mmol) in DMF (8 mL) and 2-ethynylpyridine (198 μL, 1.96 mmol), NEt_3 (275 μL, 1.96 mmol), $[Pd(PPh_3)_4]$ (31 mg, 0.19 mmol) and CuI (22 mg, 0.12 mmol) by heating for 3 h analogously to **45**. It was isolated after chromatography (EtOAc/cyclohexane, 4:6) as a brownish oil (220 mg, quant.). $[\alpha]_{578}^{20}$ = +86 (c = 0.9, $CHCl_3$), $[\alpha]_{546}^{20}$ = +92 (c = 0.9, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ = 4.13 (dd, 1 H, H-7), 4.14 (dd, 1 H, H-5a), 4.28 (dd, 1 H, H-5b), 4.35 (ddd, 1 H, H-6), 4.58 and 4.61 (AB, J_{gem} = 12.0 Hz, 2 H, CH_2Ph), 4.68 (s, 2 H, CH_2Ph), 4.71 and 4.88 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 4.78 (d, 1 H, H-8), 7.17–7.23 (m, 1 H, H-5′), 7.25–7.36 (m, 15 H, CH arom.), 7.43–7.49 (m, 2 H, H-2, H-3′), 7.57–7.65 (m, 1 H, H-4′), 8.56–8.59 (m, 1 H, H-6′) ppm; $J_{5a,6}$ = 9.3, $J_{5b,6}$ = 5.5, $J_{5a,5b}$ = 12.1, $J_{6,7}$ = 1.5, $J_{7,8}$ = 4.0 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 43.5 (C-5), 70.9 (C-8), 71.6 (2 × CH_2Ph), 72.0 (C-6), 72.6 (CH_2Ph), 74.6 (C-7), 80.9 (CH_2CH$_2$-pyr.), 96.0 (CH$_2$CH_2-pyr.), 114.5 (C-3), 122.8 (C-5′), 126.8 (C-3′), 127.7–128.4 (CH phenyls), 135.6 (C-2), 136.1 (C-4′), 137.5, 137.6, 137.7 ($C_{quat.}$ of phenyls), 142.8 (C-2′), 144.0 (C-8a), 150.0 (C-6′) ppm. HR-MS: calcd. for $[M + H]^+$ ($C_{35}H_{32}N_3O_3$) 542.2444; found 542.2447.

(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-2-(pyridin-2-ylethynyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine (51): This compound was prepared from a solution of **31** (209 mg, 0.37 mmol) in DMF (8 mL) and 2-ethynylpyridine (187 μL, 1.84 mmol), NEt_3 (260 μL, 1.84 mmol), $[Pd(PPh_3)_4]$ (29 mg, 0.18 mmol) and CuI (21 mg, 0.11 mmol) by heating for 5 h analogously to **45**. It was isolated after chromatography (EtOAc/cyclohexane, 4:6) as a brownish foam (165 mg, 82%). $[\alpha]_D^{20}$ = –9 (c = 1, $CHCl_3$). ^1H NMR (400 MHz, $CDCl_3$): δ = 4.08 (dd, 1 H, H-5a), 4.12 (dd, 1 H, H-5b), 4.14 (dd, 1 H, H-7), 4.35 (ddd, 1 H, H-6), 4.54 and 4.60 (AB, J_{gem} = 12.0 Hz, 2 H, CH_2Ph), 4.66 (s, 2 H, CH_2Ph), 4.68 and 4.87 (AB, J_{gem} = 11.9 Hz, 2 H, H-9), 4.70 (d, 1 H, H-8), 7.16 (s, 1 H, H-3), 7.17 (ddd, 1 H, H-5′), 7.2–7.4 (m, 15 H, CH arom.), 7.52 (dt, 1 H, H-3′), 7.62 (td, 1 H, H-4′), 8.57 (ddd, 1 H, H-6′) ppm; $J_{5a,6}$ = 6.7, $J_{5b,6}$ = 8.7, $J_{5a,5b}$ = 11.8, $J_{6,7}$ = 1.6, $J_{7,8}$ = 3.9, $J_{3',4'}$ = 7.7, $J_{3',5'}$ = 1.3, $J_{4',5'}$ = 7.6, $J_{4',6'}$ = 1.8, $J_{5',6'}$ = 5.0, $J_{6',3'}$ = 1.2 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 44.7 (C-5), 70.5 (C-8), 71.5, 71.6, 71.7 (C-6 and 2 × CH_2Ph), 72.5 (CH_2Ph), 74.7 (C-7), 83.3 (*C*C-pyr.), 88.7 (C*C*-pyr.), 122.4 (C-5′), 123.6 (C-2), 124.3 (C-3), 126.9 (C-3′), 127.5–128.5 (CH of phenyls), 136.0 (C-4′), 137.5, 137.6, 137.8 ($C_{quat.}$ of phenyls), 143.1, 143.4 (C-8a, C-2′), 149.8 (C-6′) ppm. HR-MS: calcd. for $[M + H]^+$ ($C_{35}H_{32}N_3O_3$) 542.2444; found 542.2448.

(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-2,3-bis(phenylethynyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine (52): This compound was prepared from a solution of **29** (474 mg, 0.68 mmol) in DMF (15 mL) and phenylacetylene (375 μL, 3.42 mmol), NEt_3 (480 μL, 3.42 mmol), $[Pd(PPh_3)_4]$ (53 mg, 0.34 mmol) and CuI (13 mg, 0.068 mmol) by heating for 12 h analogously to **45**. It was isolated after chromatography (EtOAc/cyclohexane, 1:9) as a brownish oil (311 mg, 71%). $[\alpha]_D^{20}$ = +40 (c = 1, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ = 4.07 (dd, 1 H, H-5a), 4.15 (dd, 1 H, H-7), 4.20 (dd, 1 H, H-5b), 4.38 (ddd, 1 H, H-6), 4.57 and 4.63 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 4.68 (s, 2 H, CH_2Ph), 4.70 and 4.90 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 4.73 (br. d, 1 H, H-8), 7.21–7.40, 7.50–7.54 (m, 25 H, CH arom.) ppm; $J_{5a,6}$ = 9.8, $J_{5b,6}$ = 5.8, $J_{5a,5b}$ = 12.1, $J_{6,7}$ = 1.8, $J_{7,8}$ = 3.8 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 43.8 (C-5), 70.7 (C-8), 71.8 (CH_2Ph), 71.8 (CH_2Ph), 71.9 (C-6), 72.6 (CH_2Ph), 74.4 (C-7), 76.5 (C-3-*C*CPh), 82.5 (C-2-*C*CPh), 92.7 (C-3-C*C*Ph), 99.9 (C-2-C*C*Ph), 119.3 (C-3), 122.3, 123.1 (2 × $C_{quat.}$ of phenyls), 127.6–128.9 (CH of phenyls of benzyls, C-2), 131.5, 131.6 (CH of phenyls), 137.6, 137.7, 137.8 (3 × $C_{quat.}$ of phenyls of benzyls), 143.5 (C-8a) ppm. HR-MS: calcd. for $[M]^+$ ($C_{44}H_{36}N_2O_3$) 640.2726; found 640.2723.

{(6*S*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-2-(phenylethynyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridin-3-yl}methanol (53): This compound was prepared from a solution of **37** (100 mg, 0.167 mmol) in DMF (3 mL) and phenylacetylene (93 μL, 0.84 mmol), NEt_3 (117 μL, 0.84 mmol), $[Pd(PPh_3)_4]$ (13 mg, 0.08 mmol) and CuI (3 mg, 0.02 mmol) by heating for 12 h analogously to **45**. It was isolated after chromatography (EtOAc/cyclohexane, 3:7) as a brownish oil (72 mg, 75%). $[\alpha]_D^{20}$ = +11 (c = 0.7, CH_2Cl_2). ^1H NMR (400 MHz, $CDCl_3$): δ = 4.08 (dd, 1 H, H-5a), 4.11 (dd, 1 H, H-7), 4.24 (dd, 1 H, H-5b), 4.33 (ddd, 1 H, H-6), 4.54 and 4.57 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 4.62 and 4.65 (AB, J_{gem} = 12.2 Hz, 2 H, CH_2Ph), 4.68 (d, 1 H, H-8), 4.70 and 4.76 (AB, 2 H, CH$_2$OH, J_{gem} = 13.5 Hz), 4.66 and 4.86 (AB, J_{gem} = 11.9 Hz, 2 H, CH_2Ph), 7.24–7.36, 7.48–7.52 (m, 20 H, CH of phenyls) ppm; $J_{5a,6}$ = 9.6, $J_{5b,6}$ = 5.7, $J_{5a,5b}$ = 12.0, $J_{6,7}$ = 1.8, $J_{7,8}$ = 4.0 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 43.2 (C-5), 53.8 (CH_2OH), 70.9 (C-8), 71.6 (CH_2Ph), 71.7, 71.8 (C-6, CH_2Ph), 72.5 (CH_2Ph), 74.5 (C-7), 82.1, 91.5 (C-9, C-10), 123.1, 123.2 (C-2, C-3), 127.6–128.5 (CH of phenyls), 131.5 (CH of phenyls), 133.9 ($C_{quat.}$ of phenyl),137.6, 137.7, 137.9 (3 × $C_{quat.}$ of phenyls of benzyls), 143.4 (C-8a) ppm. HR-MS: calcd. for $[M]^+$ ($C_{37}H_{34}N_2O_4$) 570.2519; found 570.2517.

(6*S*,7*S*,8*S*)-3-(2-Phenylethyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine-6,7,8-triol (54): This compound was prepared from **45** (184 mg, 0.34 mmol) and EtOH/AcOH (1:1, 6 mL) and $Pd(OH)_2$/C (200 mg) under H_2 analogously to **38**. It was isolated after chromatography (CH_2Cl_2/MeOH, 8:2) as a colourless oil (63 mg, 68%). $[\alpha]_{578}^{20}$ = +27 (c = 1.0, MeOH), $[\alpha]_{546}^{20}$ = +30 (c = 1.0, MeOH). ^1H NMR (400 MHz, CD_3OD): δ = 2.82–2.96 (m, 4 H, CH_2CH_2), 3.73 (dd, 1 H, H-5a), 3.84 (dd, 1 H, H-5b), 3.95 (dd, 1 H, H-7), 4.33 (ddd, 1 H, H-6), 4.69 (d, 1 H, H-8), 6.72 (s, 1 H, H-2), 7.15–7.19 (m, 3 H, CH arom.), 7.24–7.27 (m, 2 H, CH arom.) ppm; $J_{5a,6}$ = 7.6, $J_{5b,6}$ = 5.1 Hz, $J_{5a,5b}$ = 12.1, $J_{6,7}$ = 2.0, $J_{7,8}$ = 5.1 Hz. ^{13}C NMR (100.6 MHz, CD_3OD): δ = 27.02 (CH_2CH$_2$Ph), 36.2 (CH$_2$CH_2Ph), 46.2 (C-5), 66.9 (C-6), 68.2 (C-8), 74.2 (C-7), 126.5 (C-2), 127.7 and 129.9 (CH of phenyls), 132.9 (C-3), 142.6 ($C_{quat.}$ of phenyl), 146.3 (C-8a) ppm. HR-MS: calcd. for $[M + H]^+$ ($C_{15}H_{19}N_2O_3$) 275.1390; found 275.1389.

(6*S*,7*S*,8*S*)-2-(2-Phenylethyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine-6,7,8-triol (55): This compound was prepared from **46** (213 mg, 0.39 mmol) and EtOH/AcOH (1:1, 6 mL) and $Pd(OH)_2$/C (200 mg) under H_2 analogously to **38**. It was isolated after chromatography (CH_2Cl_2/MeOH, 95:5) as a colourless oil (60 mg, 56%). $[\alpha]_{578}^{20}$ = +3.6 (c = 1.1, MeOH). ^1H NMR (400 MHz,

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CD_3OD): δ = 2.79 (t, 2 H, CH_2CH_2Ph), 2.89 (t, 2 H, CH_2CH_2Ph), 3.89 (dd, 1 H, H-5a), 3.99 (dd, 1 H, H-7), 4.04 (dd, 1 H, H-5b), 4.35 (m, 1 H, H-6), 4.69 (d, 1 H, H-8), 6.65 (s, 1 H, H-3), 7.11–7.25 (m, 5 H, CH arom.) ppm; $J_{5a,6}$ = 7.9, $J_{5b,6}$ = 4.8, $J_{5a,5b}$ = 11.9, $J_{6,7}$ = 2.0, $J_{7,8}$ = 4.7, $J_{CH_2CH_2Ph}$= 7.5 Hz. ^{13}C NMR (100.6 MHz, CD_3OD): δ = 31.6 (CH_2CH_2Ph), 37.3 (CH_2CH_2Ph), 48.1 (C-5), 67.0 (C-6), 68.3 (C-8), 74.9 (C-7), 117.0 (C-3), 127.4, 129.8–129.9 (CH of phenyl), 143.4, 143.6 ($C_{quat.}$ of phenyl, C-2), 146.1 (C-8a) ppm. HR-MS: calcd. for $[M]^+$ ($C_{15}H_{18}N_2O_3$) 274.1317; found 274.1311.

(6*S*,7*S*,8*S*)-2-(3-Phenylpropyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine-6,7,8-triol (56): This compound was prepared from **47** (112 mg, 0.20 mmol) and EtOH/AcOH (1:1, 4 mL) and $Pd(OH)_2$/C (138 mg) under H_2 analogously to **38**. It was isolated after chromatography (CH_2Cl_2/MeOH, 9:1) as a colourless oil (38 mg, 66%). $[\alpha]_D^{20}$ = –42 (*c* = 1.0, MeOH). ^{1}H NMR (400 MHz, CD_3OD): δ = 1.87–1.95 (m, 2 H, $CH_2CH_2CH_2Ph$), 2.53 (t, 2 H, $CH_2CH_2CH_2Ph$), 2.63 (t, 2 H, $CH_2CH_2CH_2Ph$), 3.81 (dd, 1 H, H-5a), 3.86 (dd, 1 H, H-7), 4.01 (ddd, 1 H, H-6), 4.17 (dd, 1 H, H-5b), 4.51 (d, 1 H, H-8), 6.7 (s, 1 H, H-3), 7.10–7.17, 7.21–7.25 (m, 5 H, CH arom.) ppm; $J_{5a,6}$ = 6.6, $J_{5b,6}$ = 4.7, $J_{5a,5b}$ = 12.5, $J_{6,7}$ = 7.5, $J_{7,8}$ = 5.7, $J_{CH_2CH_2CH_2Ph}$ = 7.5, $J_{CH_2CH_2CH_2Ph}$ = 7.6 Hz. ^{13}C NMR (100.6 MHz, CD_3OD): δ = 28.5 ($CH_2CH_2CH_2Ph$), 32.4 ($CH_2CH_2CH_2Ph$), 36.5 ($CH_2CH_2CH_2Ph$), 49.0 (C-5), 68.8 (C-6), 69.4 (C-8), 75.2 (C-7), 116.2 (C-3), 126.7, 129.3–129.5 (CH of phenyl), 143.3, 143.6 ($C_{quat.}$ of phenyl, C-2), 146.0 (C-8a) ppm. HR-MS: calcd. for $[M + H]^+$ ($C_{16}H_{21}N_2O_3$) 289.1547; found 289.1545.

(6*S*,7*S*,8*S*)-3-(2-Cyclohexylethyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]-pyridine-6,7,8-triol (57): This compound was prepared from **48** (246 mg, 0.50 mmol) and EtOH/AcOH (1:1, 6 mL) and $Pd(OH)_2$/C (250 mg) under H_2 analogously to **38**. It was isolated after chromatography (CH_2Cl_2/MeOH, 9:1) as a colourless oil (70 mg, 55%). $[\alpha]_D^{20}$ = +19 (*c* = 1, MeOH). ^{1}H NMR (400 MHz, CD_3OD): δ = 0.96 (m, 2 H, H-2′,H-6′), 1.12–1.38 (m, 4 H, H-1′, H-3′, H-5′, H-4′), 1.50 (q, 2 H, CH_2CH_2-cyclohex.), 1.65–1.85 (m, 5 H, H-2′, H-6′, H-3′, H-5′, H-4′), 2.55 (m, 1 H, CH_2CH_2-cyclohex.), 3.77 (dd, 1 H, H-5a), 3.98 (dd, 1 H, H-5b), 3.99 (dd, 1 H, H-7), 4.38 (ddd, 1 H, H-6), 4.69 (d, 1 H, H-8), 6.72 (s, 1 H, H-2) ppm; $J_{5a,6}$ = 7.8, $J_{5b,6}$ = 5.0, $J_{5a,5b}$ = 12.0, $J_{6,7}$ = 2.0, $J_{7,8}$ = 5.0 Hz. ^{13}C NMR (100.6 MHz, CD_3OD): δ = 22.0 (CH_2CH_2-cyclohex.), 27.4 (C-3′, C-5′), 27.7 (C-4′), 34.3, 34.3 (C-2′, C-6′), 36.8 (CH_2CH_2-cyclohex.), 38.5 (C-1′), 45.7 (C-5), 66.5 (C-6), 67.9 (C-8), 73.9 (C-7), 125.4 (C-2), 133.3 (C-3), 145.6 (C-8a) ppm. HR-MS: calcd. for $[M + H]^+$ ($C_{15}H_{25}N_2O_3$) 281.1865; found 281.1862. $C_{15}H_{24}N_2O_3$ (280.37): calcd. C 64.26, H 8.63, N 9.99; found C 64.2, H 8.6, N 9.6.

(6*S*,7*S*,8*S*)-2-(2-Cyclohexylethyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]-pyridine-6,7,8-triol (58): This compound was prepared from **49** (248 mg, 0.50 mmol) and EtOH/AcOH (1:1, 6 mL) and $Pd(OH)_2$/C (220 mg) under H_2 analogously to **38**. It was isolated after chromatography (CH_2Cl_2/MeOH, 9:1) as a colourless oil (62 mg, 48%). $[\alpha]_D^{20}$ = +3.6 (*c* = 0.8, MeOH). ^{1}H NMR (400 MHz, CD_3OD): δ = 0.92 (m, 2 H, H-2′, H-6′), 1.12–1.31 (m, 4 H, H-1′, H-3′, H-5′, H-4′), 1.49 (dd, 2 H, CH_2CH_2-cyclohex.), 1.62–1.80 (m, 5 H, H-2′, H-6′,H-3′, H-5′, H-4′), 2.51 (t, 2 H, CH_2CH_2-cyclohex.), 3.91 (dd, 1 H, H-5a), 3.99 (dd, 1 H, H-7), 4.06 (dd, 1 H, H-5b), 4.36 (ddd, 1 H, H-6),4.68 (d, 1 H, H-8), 6.69 (s, 1 H, H-3) ppm; $J_{5a,6}$ = 7.7, $J_{5b,6}$ = 5.0, $J_{5a,5b}$ = 12.3, $J_{6,7}$ = 1.8, $J_{7,8}$ = 5.0 Hz. ^{13}C NMR (100.6 MHz, CD_3OD): δ = 26.3 (CH_2CH_2-cyclohex.), 27.4 (C-3′, C-5′), 27.8 (C-4′), 34.4 (C-2′, C-6′), 38.2 (CH_2CH_2-cyclohex.), 38.5 (C-1′), 47.6 (C-5), 66.6 (C-6), 67.7 (C-8), 74.4 (C-7), 116.1 (C-3), 143.9 (C-2), 145.4 (C-8a) ppm. HR-MS: calcd. for $[M + H]^+$ ($C_{15}H_{25}N_2O_3$) 281.1865; found 281.1860.

(6*S*,7*S*,8*S*)-2,3-Bis(2-phenylethyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]-pyridine-6,7,8-triol (59): This compound was prepared from **52** (146 mg, 0.23 mmol) and EtOH/AcOH (1:1, 8 mL) and $Pd(OH)_2$/C (100 mg) under H_2 analogously to **38**. It was isolated after chromatography (CH_2Cl_2/MeOH, 9:1) as a colourless oil (36 mg, 42%). $[\alpha]_{578}^{20}$ = +21 (*c* = 1, MeOH), $[\alpha]_{546}^{20}$ = +23 (*c* = 1, MeOH). ^{1}H NMR (400 MHz, CD_3OD): δ = 2.50–2.70 (m, 8 H, 2×CH_2CH_2Ph), 3.65–3.75 (m, 2 H, 2×H-5), 3.96 (dd, 1 H, H-7), 4.30 (ddd, 1 H, H-6), 4.71 (d, 1 H, H-8), 6.99–7.00, 7.08–7.23 (m, 10 H, CH arom.) ppm; $J_{5,6}$ = 7.4, $J_{5,6}$ = 5.3, $J_{6,7}$ = 2.1, $J_{7,8}$ = 5.0 Hz. ^{13}C NMR (100.6 MHz, CD_3OD): δ = 25.9 (C-2-CH_2CH_2Ph), 29.9 (C-3-CH_2CH_2Ph), 36.6 (C-2-CH_2CH_2Ph) 37.7 (C-3-CH_2CH_2Ph) 45.8 (C-5), 66.6 (C-6), 67.8 (C-8), 73.9 (C-7), 126.8, 127.2 (CH of phenyl), 127.3 (C-3), 129.3–129.7 (CH of phenyl), 138.1 (C-2), 142.2, 143.3 ($C_{quat.}$ of phenyls), 144.5 (C-8a) ppm. HR-MS: calcd. for $[M]^+$ ($C_{23}H_{26}N_2O_3$) 378.1943; found 378.1949.

(6*S*,7*S*,8*S*)-3-(Hydroxymethyl)-2-(2-phenylethyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine-6,7,8-triol (60): This compound was prepared from **53** (73 mg, 0.13 mmol) and EtOH/AcOH (1:1, 2 mL) and $Pd(OH)_2$/C (60 mg) under H_2 analogously to **38**. It was isolated after chromatography (EtOAc/MeOH, 6:4) as a colourless oil (19 mg, 49%). $[\alpha]_D^{20}$ = +2.4 (*c* = 0.8, MeOH). ^{1}H NMR (400 MHz, CD_3OD): δ = 2.75–2.90 (m, 4 H, CH_2CH_2Ph), 3.89 (dd, 1 H, H-5a), 4.00 (dd, 1 H, H-7), 4.10 (dd, 1 H, H-5b), 4.30 (s, 2 H, CH_2OH), 4.39 (ddd, 1 H, H-6), 4.71 (d, 1 H, H-8), 7.12–7.15, 7.21–7.24 (m, 5 H, CH arom.) ppm; $J_{5a,6}$ = 7.7, $J_{5b,6}$ = 5.0, $J_{5a,5b}$ = 12.1, $J_{6,7}$ = 2.2, $J_{7,8}$ = 4.8 Hz. ^{13}C NMR (100.6 MHz, CD_3OD): δ = 30.2, 37.7 (CH_2CH_2Ph), 45.9 (C-5), 52.8 (CH_2OH), 66.4 (C-6), 67.9 (C-8), 74.0 (C-7), 126.9 (CH of phenyl), 127.2 (C-3), 129.3, 129.5 (CH of phenyl), 140.4 (C-2), 143.2 ($C_{quat.}$ of phenyl), 145.7 (C-8a) ppm. HR-MS: calcd. for $[M]^+$ ($C_{16}H_{20}N_2O_4$) 304.1423; found 304.1430.

(6*S*,7*S*,8*S*)-3-[2-(Pyridin-2-yl)ethyl]-5,6,7,8-tetrahydroimidazo-[1,2-*a*]pyridine-6,7,8-triol (61) and (6*S*,7*S*,8*S*)-3-[2-(Piperidin-2-yl)-ethyl]-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine-6,7,8-triol (62): A solution of **50** (250 mg, 0.462 mmol) in EtOH/AcOH (1:1, 6 mL) was stirred under H_2 (1 bar) at room temperature in the presence of $Pd(OH)_2$/C (300 mg) for 48 h. The suspension was centrifuged and the catalyst rinsed several times with hot MeOH. The combined organic solutions were concentrated to dryness in vacuo. The residue was then dissolved in anhydrous CH_2Cl_2 (8 mL) and cooled to –78 °C. BCl_3 (1 M in CH_2Cl_2, 6.93 mL, 6.93 mmol) was added with stirring. After 1 h, the reaction mixture was placed in a freezer at –20 °C for 12 h, then cooled to –78 °C, hydrolysed with MeOH (10 mL), warmed up to room temp. and concentrated in vacuo. The residue was purified by flash chromatography (CH_2Cl_2/MeOH, 8:2) to give **61** (37 mg) and a mixture of **61** and **62** (62 mg) (for the analysis of **62** see below). **61:** $[\alpha]_D^{20}$ = +20 (*c* = 1, MeOH). ^{1}H NMR (400 MHz, CD_3OD): δ = 2.97 (m, 2 H, CH_2CH_2-pyr.), 3.10 (m, 2 H, CH_2CH_2-pyr.), 3.77 (dd, 1 H, H-5a), 3.97 (dd, 1 H, H-5b), 3.98 (dd, 1 H, H-7), 4.37 (ddd, 1 H, H-6), 4.68 (d, 1 H, H-8), 6.68 (s, 1 H, H-2), 7.26 (ddd, 1 H, H-5′), 7.30 (dt, 1 H, H-3′), 7.73 (td, 1 H, H-4′), 8.45 (ddd, 1 H, H-6′) ppm; $J_{5a,6}$ = 7.8, $J_{5b,6}$ = 5.1, $J_{5a,5b}$ = 12.1, $J_{6,7}$ = 2.0, $J_{7,8}$ = 5.0, $J_{3',4'}$ = 7.8, $J_{3',5'} \approx$ 1, $J_{4',5'}$ = 7.8, $J_{4',6'}$ = 1.8, $J_{5',6'}$ = 5.0, $J_{6',3'}$ = 1.0 Hz. ^{3}C NMR (100.6 MHz, $CDCl_3$): δ = 24.7 (CH_2CH_2-pyr.), 37.3 (CH_2CH_2-pyr.), 45.7 (C-5), 66.6 (C-6), 68.0 (C-8), 74.0 (C-7), 123.1 (C-5′), 124.9 (C-3′), 126.3 (C-2), 131.3 (C-3), 138.8 (C-4′), 146.0 (C-8a), 149.8 (C-6′), 161.6 (C-2′) ppm. HR-MS: calcd. for $[M + H]^+$ ($C_{14}H_{18}N_3O_3$) 276.1343; found 276.1343.

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(6*S*,7*S*,8*S*)-2-[2-(Pyridin-2-yl)ethyl]-5,6,7,8-tetrahydroimidazo-[1,2-*a*]pyridine-6,7,8-triol (63): A solution of **51** (410 mg, 0.757 mmol) in EtOAc (15 mL) was stirred under H_2 (1 bar) at room temperature in the presence of 5% Pd/C (240 mg) for 6 h. The suspension was centrifuged and the catalyst rinsed several times with hot EtOAc. The combined organic solutions were concentrated to dryness in vacuo. The residue was dissolved in anhydrous CH_2Cl_2 (15 mL) and cooled to –78 °C. BCl_3 (1 M in CH_2Cl_2, 11.4 mL, 11.4 mmol) was added with stirring. The reaction mixture was left at –40 °C for 4 h and then placed in a freezer at –20 °C for 12 h, cooled again to –78 °C, hydrolysed with MeOH (5 mL), warmed up to room temp. and concentrated in vacuo. The residue was purified by flash chromatography (CH_2Cl_2/MeOH, 8:2) to give **63** (181 mg, 87%) as a yellowish oil. $[\alpha]_D^{20}$ = –9 (*c* = 1, MeOH). ^{1}H NMR (400 MHz, CD_3OD): δ = 2.96 (m, 2 H, CH_2CH$_2$-pyr.), 3.09 (m, 2 H, CH$_2$CH_2-pyr.), 3.97 (dd, 1 H, H-5a), 3.98 (dd, 1 H, H-7), 4.11 (dd, 1 H, H-5b), 4.36 (ddd, 1 H, H-6), 4.74 (d, 1 H, H-8), 6.79 (s, 1 H, H-3), 7.25 (ddd, 1 H, H-5′), 7.30 (br. d, 1 H, H-3′), 7.74 (td, 1 H, H-4′), 8.43 (br. d, 1 H, H-6′) ppm; $J_{5a,6}$ = 6.2, $J_{5b,6}$ = 4.5, $J_{5a,5b}$ = 12.6, $J_{6,7}$ = 2.0, $J_{7,8}$ = 5.8, $J_{3',4'}$ = 7.8, $J_{4',5'}$ = 7.8, $J_{4',6'}$ = 1.8, $J_{5',6'}$ = 5.0 Hz. ^{13}C NMR (100.6 MHz, CD_3OD): δ = 28.5 (*C*H$_2$CH$_2$-pyr.), 38.1 (CH$_2$*C*H$_2$-pyr.), 48.5 (C-5), 67.0 (C-6), 67.5 (C-8), 74.2 (C-7), 117.1 (C-3), 123.0 (C-5′), 124.8 (C-3′), 138.8 (C-4′), 141.1 (C-2), 145.9 (C-8a), 149.6 (C-6′), 162.0 (C-2′) ppm. HR-MS: calcd. for $[M + H]^+$ ($C_{14}H_{18}N_3O_3$) 276.1343; found 276.1347.

(6*S*,7*S*,8*S*)-3-[2-(Piperidin-2-yl)ethyl]-5,6,7,8-tetrahydroimidazo-[1,2-*a*]pyridine-6,7,8-triol (62): This compound was prepared from the mixture **61** + **62** (see above, 62 mg, ≈0.22 mmol), EtOH/AcOH (1:1, 2 mL) and $Pd(OH)_2$/C (60 mg) under H_2 analogously to **38**. Compound **62** was isolated after chromatography (CH_2Cl_2/MeOH–NH_3, 8:2, then MeOH/NH_3) as a colourless oil and as a mixture of diastereomers (30 mg, 47%). $[\alpha]_{578}^{20}$ = +11 (*c* = 1.0, MeOH), $[\alpha]_{546}^{20}$ = +12 (*c* = 1.0, MeOH). ^{1}H NMR (400 MHz, CD_3OD): δ = 1.25–1.37, 1.41–1.62, 1.72–1.96 (m, 8 H, CH$_2$CH_2-pip., 2×H-3′, 2×H-4′, 2×H-5′), 2.65 (m, 1 H,CH_2CH$_2$-pip.), 2.75–2.90 (m, 2 H, H-6′ and H-2′), 3.20 (br. d, 1 H, H6′), 3.78, 3.79 (2×dd, 2 H, 2×H-5a)*, 3.98–4.04 (m, 2 H, H-7, H-5b)*, 4.39 (ddd, 1 H, H-6), 4.68 (d, 1 H, H-8), 6.76 (s, 1 H, H-2) ppm; $J_{5a,6}$ = 7.8, $J_{5b,6}$ = 5.1, $J_{5a,5b}$ = 12.1, $J_{6,7}$ = 2.0, $J_{7,8}$ = 5.0 Hz. ^{13}C NMR (100.6 MHz, CD_3OD): δ = 20.7 (*C*H$_2$CH$_2$-pip.)**, 24.3, 25.1 (C-4′, C-5′), 31.1 (C-3′), 34.5 (CH$_2$*C*H$_2$-pip.), 45.7 (C-5)**, 46.8 (C-6′), 57.4 (C-2′), 66.5 (C-6)**, 67.9 (C-8), 73.9 (C-7), 125.9 (C-2)**, 131.9 (C-3), 146.1 (C-8a) ppm; *one signal for each diastereomer; **two very close signals were detected for this C atom because of the presence of the two diastereomers. HR-MS: calcd. for $[M + H]^+$ ($C_{14}H_{24}N_3O_3$) 282.1812; found 282.1811.

(6*S*,7*S*,8*S*)-2-[2-(Piperidin-2-yl)ethyl]-5,6,7,8-tetrahydroimidazo-[1,2-*a*]pyridine-6,7,8-triol (64): This compound was prepared from a mixture of **63** (64 mg, 0.232 mmol) and EtOH/AcOH (1:1, 4 mL) and $Pd(OH)_2$/C (70 mg) under H_2 analogously to **38**. It was isolated after chromatography on TLC plates (CH_2Cl_2/MeOH/NH_4OH, 5:4:1) as a colourless oil (30 mg, 47%). $[\alpha]_{578}^{20}$ = +1.4 (*c* = 1.1, MeOH). ^{1}H NMR (400 MHz, CD_3OD): δ = 1.11–1.23 (m, 1 H, H-3′), 1.28–1.53 (m, 2 H, H-5′, H-4′), 1.58–1.83 (m, 3 H, H-3′, H-4′, H-5′) 1.70 (br. quint, 2 H, CH$_2$CH_2-pip.), 2.52–2.60 (m, 2 H, CH_2CH$_2$-pip., H-2′), 2.63 (m, 1 H, H-6′), 3.06 (m, 1 H, H-6′), 3.91 (dd, 1 H, H-5a), 3.98 (dd, 1 H, H-7), 4.07 (dd, 1 H, H-5b), 4.36 (ddd, 1 H, H-6), 4.67 (d, 1 H, H-8), 6.74 (s, 1 H, H-3) ppm; $J_{5a,6}$ = 7.6, $J_{5b,6}$ = 5.0, $J_{5a,5b}$ = 12.3, $J_{6,7}$ = 2.0, $J_{7,8}$ = 5.1 Hz. ^{13}C NMR (100.6 MHz, CD_3OD): δ = 25.2 (*C*H$_2$CH$_2$-pip., C-4′), 26.2 (C-5′), 32.5 (C-3′), 37.1 (CH$_2$*C*H$_2$-pip.), 47.3 (C-6′), 47.7 (C-5), 57.4 (C-2′), 66.7 (C-6), 67.8 (C-8), 74.4 (C-7), 116.4 (C-3), 143.0 (C-2), 147.8 (C-8a) ppm. HR-MS: calcd. for $[M + H]^+$ ($C_{14}H_{24}N_3O_3$) 282.1812; found 282.1813.

(1*R*,2*S*,3*R*)-1-(1,3-Dithian-2-yl)butane-1,2,3,4-tetraol (66): D-Xylose (25.00 g, 0.166 mol) was added portionwise to a stirred solution of propanedithiol (16 mL) in concentrated HCl (37%) (12.5 mL) at 0 °C. The reaction mixture was warmed up to room temperature, stirred overnight and basified with concentrated NH_4OH (≈20 mL). The reaction mixture was then concentrated in vacuo. The residue was co-evaporated with toluene and *n*-butanol three times and crystallised from MeOH (5.94 g). The mother liquor, after concentration in vacuo, was purified by chromatography (EtOAc/MeOH, 9:1) to afford pure **66** (31.70 g). Total yield: 94%. A small quantity was recrystallised from MeOH. M.p. 88–90 °C (ref.[22] 76–77 °C). $[\alpha]_D^{20}$ = –4.4 (*c* = 1.0, MeOH) {ref.[22] $[\alpha]_D^{20}$ = –2.3 (*c* = 1, MeOH)}. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 1.84–1.94, 2.01–2.09 (m, 2 H, SCH$_2$CH_2CH$_2$), 2.73–2.84, 2.88–2.96 (m, 4 H, 2×SCH_2), 3.60 (dd, 1 H, H-5a), 3.66 (dd, 1 H, H-5b), 3.77 (td, 1 H, H-4), 3.91 (dd, 1 H, H-2), 3.97 (dd, 1 H, H-3), 4.18 (d, 1 H, H-1) ppm; $J_{1,2}$ = 7.6, $J_{2,3}$ = 3.4, $J_{3,4}$ = 4.0, $J_{4,5a}$ = 6.1, $J_{4,5b}$ = 4.7, $J_{5a,5b}$ = 11.3 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 27.1 (SCH$_2$*C*H$_2$CH$_2$), 29.1, 29.6 (2×S*C*H$_2$CH$_2$CH$_2$), 50.2 (C-1), 64.3 (C-5), 71.6 (C-3), 74.0 (C-2), 74.5 (C-4) ppm. $C_8H_{16}O_4S_2$ (240.34): calcd. C 39.98, H 6.71, S 26.68; found C 40.1, H 6.9, S 26.4.

(1*R*,2*S*,3*R*)-1-(1,3-Dithian-2-yl)-4-(trityloxy)butane-1,2,3-triol (67): This compound was prepared from **66** (13.00 g, 54.1 mmol), TrCl (19.6 g, 70.3 mmol) and DMAP (cat.) in pyridine (250 mL) analogously to **6**. It was purified by chromatography (EtOAc/cyclohexane, 3:7) as a yellowish foam (23.2 g, 89%). $[\alpha]_D^{20}$ = –23 (*c* = 1.0, MeOH). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 1.89–2.06 (m, 2 H, SCH$_2$CH_2CH$_2$), 2.55–2.64 (m, 2 H, SCH_2CH$_2$CH_2), 2.76–2.86 (m, 2 H, SCH_2CH$_2$CH_2), 3.29 (dd, 1 H, H-5a), 3.36 (dd, 1 H, H-5b), 3.89 (dd, 1 H, H-2), 3.91 (ddd, 1 H, H-4), 4.02 (d, 1 H, H-1), 4.18 (dd, 1 H, H-3), 7.18–7.31, 7.42–7.46 (m, 15 H, CH arom.) ppm; $J_{1,2}$ = 9.0, $J_{2,3}$ = 1.8, $J_{3,4}$ = 3.5, $J_{4,5a}$ = 5.3, $J_{4,5b}$ = 4.8, $J_{5a,5b}$ = 9.8 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 25.2 (SCH$_2$*C*H$_2$CH$_2$), 26.3, 27.0 (S*C*H$_2$CH$_2$*C*H$_2$), 46.7 (C-1), 64.8 (C-5), 69.6 (C-3), 72.2 (C-2), 72.8 (C-4), 86.9 (*C*Ph$_3$), 127.1, 127.9, 128.6 (*C*H of phenyls), 143.6 ($C_{quat.}$ of phenyls) ppm.

2-[(1*R*,2*S*,3*R*)-1,2,3-Tris(benzyloxy)-4-(trityloxy)butyl]-1,3-dithiane (68): This compound was prepared from **67** (10.00 g, 20.7 mmol), *n*Bu$_4$NI (cat.), NaH (60% in oil, 4.00 g, 103.6 mmol) and BnBr (8.4 mL, 70.4 mmol) in DMF (100 mL) analogously to **7**. It was purified by flash chromatography (EtOAc/cyclohexane, 5:95) as a yellow oil (14.47 g, 93%). $[\alpha]_D^{20}$ = –22 (*c* = 1.0, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 1.81–2.03 (m, 2 H, SCH$_2$CH_2CH$_2$), 2.57 (m, 2 H, SCH_2CH$_2$CH$_2$), 2.77 (m, 2 H, SCH_2CH$_2$CH$_2$S), 3.33 (dd, 1 H, H-5a), 3.43 (dd, 1 H, H-5b), 3.77 (ddd, 1 H, H-4), 3.83 (t, 1 H, H-2), 3.89 (d, 1 H, H-1), 4.19 (t, 1 H, H-3), 4.39 and 4.78 (AB, J_{gem} = 11.1 Hz, 2 H, CH_2Ph), 4.50 and 4.69 (AB, J_{gem} = 11.8 Hz, 2 H, CH_2Ph), 4.63 and 4.73 (AB, J_{gem} = 11.2 Hz, 2 H, CH_2Ph), 7.12–7.14, 7.21–7.36, 7.44–7.46 (m, 30 H, C*H* arom.) ppm; $J_{1,2}$ = 5.2, $J_{2,3}$ = 5.2 Hz; $J_{3,4}$ = 5.0, $J_{4,5a}$ = 5.1, $J_{4,5b}$ = 4.0, $J_{5a,5b}$ = 10.0 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 26.0 (SCH$_2$CH_2CH$_2$S), 29.5, 29.9 (S*C*H$_2$CH$_2$*C*H$_2$S), 49.3 (C-1), 62.8 (C-5), 72.2 (*C*H$_2$Ph), 74.6 (*C*H$_2$Ph), 75.2 (*C*H$_2$Ph), 78.0 (C-4), 79.4 (C-3), 81.3 (C-2), 86.8 (*C*Ph$_3$), 126.9–128.7 (*C*H of phenyls), 138.3, 138.4, 138.6 ($C_{quat.}$ of phenyls of benzyls), 143.9 ($C_{quat.}$ of phenyls of trityl) ppm. $C_{48}H_{48}O_4S_2$ (753.02): calcd. C 76.56, H 6.42, S 8.52; found C 76.7, H 6.5, S 7.8.

(2*R*,3*S*,4*R*)-2,3,4-Tris(benzyloxy)-5-(trityloxy)pentanal (69): This compound was prepared from **68** (10.00 g, 1.32 mmol), 2,6-lutidine (1.25 mL, 10.6 mmol) and NBS (942 mg, 5.30 mmol) in acetone

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(33 mL) and H_2O (4 mL) analogously to **8**. After evaporation of the acetone, the aqueous phase was extracted with CH_2Cl_2, and after the same treatment as for **8**, the residue was purified by flash chromatography (EtOAc/cyclohexane, 5:95) to give **69** (393 mg, 45%) as a yellowish oil. $[\alpha]_D^{20}$ = +7 (*c* = 1.0, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 3.25 (dd, 1 H, H-5a), 3.36 (dd, 1 H, H-5b), 3.78 (d, 1 H, H-2), 3.84 (ddd, 1 H, H-4), 4.08 (t, 1 H, H-3), 4.27 and 4.59 (AB, J_{gem} = 11.7 Hz, 2 H, CH_2Ph), 4.46 and 4.54 (AB, J_{gem} = 11.6 Hz, 2 H, CH_2Ph), 4.47 and 4.52 (AB, J_{gem} = 11.4 Hz, 2 H, CH_2Ph), 7.14–7.40 (m, 30 H, CH arom.), 9.59 (s, 1 H, H-1) ppm; $J_{1,2} \approx 0$, $J_{2,3} \approx 4.8$, $J_{3,4} \approx 4.5$, $J_{4,5a}$ = 5.3, $J_{4,5b}$ = 5.4 Hz; $J_{5a,5b}$ = 9.9 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 62.4 (C-5), 73.0 (*C*H$_2$Ph), 73.2 (*C*H$_2$Ph), 74.1 (*C*H$_2$Ph), 77.4 (C-4), 79.1 (C-3), 81.8 (C-2), 86.9 (*C*Ph$_3$), 127.1–128.6 (*C*H of phenyls), 137.2, 137.6, 137.9 ($C_{quat.}$ of phenyls of benzyls), 143.8 ($C_{quat.}$ of phenyls of trityl), 201.2 (C-1) ppm.

(2*R*,3*R*,4*S*)-2,3,4-Tris(benzyloxy)-4-(1*H*-imidazol-2-yl)butan-1-ol (70): This compound was prepared from **69** (5.26 g, 7.93 mmol), MeOH/NH_3 (130 mL) and glyoxal (40% in H_2O; 13.5 mL, 119 mmol) analogously to **9**. The crude product obtained after extraction was not purified by chromatography but directly dissolved in dioxane (100 mL) and treated with aq. 4 M HCl (100 mL) analogously to **12**. The residue was purified by flash chromatography (EtOAc) to give **70** (2.65 g, 73%) as a colourless solid. M.p. 118–119 °C (CH_2Cl_2/pentane). $[\alpha]_D^{20}$ = +25 (*c* = 1.0, $CHCl_3$). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 1.95, 2.48 (2×s very br, 1 H, OH), 3.56 (dd, 1 H, H-4a), 3.73 (dd, 1 H, H-4b), 3.85 (dt, 1 H, H-3), 3.93 (dd, 1 H, H-2), 4.22 and 4.59 (AB, J_{gem} = 11.0 Hz, 2 H, CH_2Ph), 4.36 and 4.47 (AB, J_{gem} = 11.6 Hz, 2 H, CH_2Ph), 4.65 and 4.68 (AB, J_{gem} = 11.4 Hz, 2 H, CH_2Ph), 4.93 (d, 1 H, H-1), 6.92, 7.04 (2×br. s, 2×H, H-4′, H-5′), 7.13–7.16, 7.26–7.34 (m, 15 H, C*H* arom.), 9.60 (br. s, 1 H, NH) ppm; $J_{1,2}$ = 3.7, $J_{2,3}$ = 6.3, $J_{3,4a}$ = 4.6, $J_{3,4b}$ = 4.3, $J_{4a,4b}$ = 11.9 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 61.5 (C-4), 71.7 (*C*H$_2$Ph), 73.1 (*C*H$_2$Ph), 74.6 (C-1), 74.8 (*C*H$_2$Ph), 79.5 (C-3), 81.3 (C-2), 116.2 (C-4′ and C-5′), 127.9–129.2 (*C*H of phenyls), 137.1, 137.6, 138.1 (3×$C_{quat.}$ of phenyls of benzyls), 145.9 (C-2′) ppm. $C_{28}H_{30}N_2O_4$ (358.54): calcd. C 73.34, H 6.59, N 6.11; found C 73.6, H 6.7, N 6.1.

(2*R*,3*R*,4*S*)-2,3,4-Tris(benzyloxy)-4-(4,5-diiodo-1*H*-imidazol-2-yl)butan-1-ol (71): This compound was prepared from **70** (3.15 g, 6.86 mmol) and NIS (3.71 mg, 16.5 mmol) in acetonitrile (90 mL) analogously to **23**. It was purified by flash chromatography (EtOAc/cyclohexane, 4:6) as a colourless solid (4.06 g, 83%). M.p. 161–162 °C (CH_2Cl_2/hexane). $[\alpha]_D^{20}$ = +23 (*c* = 1.0, $CHCl_3$). ^{1}H NMR (400 MHz, CD_3OD): δ = 3.53 (ddd, 1 H, H-3), 3.58 (dd, 1 H, H-4a), 3.71 (dd, 1 H, H-4b), 3.95 (dd, 1 H, H-2), 4.36 and 4.47 (AB, J_{gem} = 11.5 Hz, 2 H, CH_2Ph), 4.48 and 4.60 (AB, J_{gem} = 11.1 Hz, 2 H, CH_2Ph), 4.49 and 4.57 (AB, J_{gem} = 11.4 Hz, 2 H, CH_2Ph), 4.77 (d, 1 H, H-1), 7.15–7.30 (m, 15 H, C*H* arom.) ppm; $J_{1,2}$ = 5.6, $J_{2,3}$ = 4.9, $J_{3,4a}$ = 5.5, $J_{3,4b}$ = 4.2, $J_{4a,4b}$ = 11.3 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 61.4 (C-4), 72.1 (*C*H$_2$Ph), 73.2 (*C*H$_2$Ph), 74.4 (C-1), 74.6 (*C*H$_2$Ph), 75.7 (C-4′ or C-5′), 79.2, 80.3 (C-2, C-3), 94.4 (C-4′ or C-5′), 127.8–128.7 (*C*H of phenyls), 136.7, 136.9, 137.7 (3×$C_{quat.}$ of phenyls of benzyls), 151.9 (C-2′) ppm. $C_{28}H_{28}I_2N_2O_4$ (710.34): calcd. C 47.34, H 3.97, I 35.73, N 3.94; found C 47.1, H 3.9, I 35.9, N 3.9.

(6*R*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-2,3-diiodo-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine (72) and (6*R*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-2-iodo-5,6,7,8-tetrahydroimidazopyridine (73): Compound **72** was prepared from **71** (1.500 g, 2.11 mmol), pyridine (32 mL) and MsCl (570 μL, 7.4 mmol) analogously to **18**. It was purified by flash chromatography (EtOAc/cyclohexane, 2:8) (1.215 g, 83%) and was used directly for the deiodination. **72:** ^{1}H NMR (400 MHz, $CDCl_3$): δ = 3.80–3.88 (m, 2 H, H-5a, H-6), 3.96 (m, 1 H, H-5b), 4.09 (dd, 1 H, H-7), 4.49 and 4.67 (AB, J_{gem} = 11.6 Hz, 2 H, CH_2Ph), 4.52 and 4.61 (AB, J_{gem} = 11.6 Hz, 2 H, CH_2Ph), 4.66 (d, 1 H, H-8), 4.77 and 5.05 (AB, J_{gem} = 11.6 Hz, 2 H, CH_2Ph), 7.20–7.28, 7.34–7.36 (m, 15 H, C*H* arom.) ppm; $J_{6,7}$ = 5.6, $J_{7,8}$ = 3.2 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 48.8 (C-5), 71.9 (C-8, *C*H$_2$Ph), 72.3 (*C*H$_2$Ph), 72.9 (*C*H$_2$Ph), 73.4 (C-6), 77.3 (C-7), 82.2 (C-2), 95.4 (C-3), 127.4–128.4 (*C*H of phenyls), 137.1, 137.1, 137.7 (3×$C_{quat.}$ of phenyls of benzyls), 148.2 (C-8a) ppm. Compound **73** was prepared from **72** (1.082 g, 1.56 mmol), EtMgBr (3 M in Et_2O; 575 μL, 1.72 mmol) and CH_2Cl_2 (12 mL) analogously to **31**. It was purified by flash chromatography (EtOAc/cyclohexane, 2:8) (771 g, 87%) as a yellowish oil. $[\alpha]_D^{20}$ = +20 (*c* = 1.2, CH_2Cl_2). ^{1}H NMR (400 MHz, $CDCl_3$): δ = 3.86 (td, 1 H, H-6), 3.93 (dd, 1 H, H-5a), 4.10 (dd, 1 H, H-7), 4.11 (dd, 1 H, H-5b), 4.53 and 4.72 (AB, J_{gem} = 11.6 Hz, 2 H, CH_2Ph), 4.58 and 4.68 (AB, 2 H, CH_2Ph, J_{gem} = 11.6), 4.69 (d, 1 H, H-8), 4.80 and 5.09 (AB, J_{gem} = 11.6 Hz, 2 H, CH_2Ph), 6.86 (s, 1 H, H-3), 7.21–7.34, 7.39–7.40 (m, 15 H, C*H* arom.) ppm; $J_{5a,6}$ = 6.0, $J_{5b,6}$ = 4.6, $J_{5a,5b}$ = 12.4, $J_{6,7}$ = 6.4, $J_{7,8} \approx$ 4.0 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 46.1 (C-5), 72.2, 72.3, 72.4 (2×*C*H$_2$Ph, C-8), 73.2 (*C*H$_2$Ph), 73.8 (C-6), 78.7 (C-7), 82.1 (C-2), 124.2 (C-3), 127.5–128.4 (*C*H of phenyls), 137.4, 137.5, 138.1 (3×$C_{quat.}$ of phenyls benzyls), 145.4 (C-8a) ppm. $C_{28}H_{27}IN_2O_3$ (566.43): calcd. C 59.37, H 4.80, I 22.40, N 4.95; found C 59.0, H 4.9, I 22.4, N 5.0.

(6*R*,7*S*,8*S*)-6,7,8-Tris(benzyloxy)-2-(phenylethynyl)-5,6,7,8-tetrahydroimidazopyridine (74): This compound was prepared from a solution of **73** (390 mg, 0.69 mmol) in DMF (12 mL) and 3-phenyl-1-propyne (378 μL, 3.44 mmol), NEt_3 (480 μL, 3.44 mmol), [$Pd(PPh_3)_4$] (54 mg, 0.34 mmol) and CuI (14 mg, 0.07 mmol) by heating for 12 h analogously to **45**. It was isolated after flash chromatography (EtOAc/cyclohexane, 2:8) as a brownish oil (265 mg, 71%) which was used directly for the next step. ^{1}H NMR (400 MHz, $CDCl_3$): δ = 3.90 (td, 1 H, H-6), 3.95 (dd, 1 H, H-5a), 4.13 (dd, 1 H, H-5b), 4.14 ("dd", 1 H, H-7), 4.53 and 4.73 (AB, J_{gem} = 11.8 Hz, 2 H, CH_2Ph), 4.60 and 4.71 (AB, J_{gem} = 11.6 Hz, 2 H, CH_2Ph), 4.81 (s very b, 1 H, H-8), 4.85 and 5.15 (AB, J_{gem} = 11.6 Hz, 2 H, CH_2Ph), 7.03 (s, 1 H, H-3), 7.20–7.32, 7.35–7.40, 7.45–7.50 (m, 20 H, C*H* arom.) ppm; $J_{5a,6}$ = 5.9, $J_{5b,6}$ = 4.2, $J_{5a,5b}$ = 12.4, $J_{6,7}$ = 5.8 Hz. ^{13}C NMR (100.6 MHz, $CDCl_3$): δ = 46.3 (C-5), 72.2 (*C*H$_2$Ph, C-8), 72.5 (*C*H$_2$Ph), 73.1 (*C*H$_2$Ph), 73.8 (C-6), 78.5 (C-7), 82.9 (*C*CPh), 89.5 (C*C*Ph), 122.5 (C-3), 123.1 ($C_{quat.}$ of phenyl), 124.3 (C-2), 127.5–128.4 (*C*H of phenyls), 137.4, 137.5, 138.1 (3×$C_{quat.}$ of phenyls of benzyls), 131.4 (*C*H of phenyl), 143.7 (C-8a) ppm.

(6*R*,7*S*,8*S*)-2-(2-Phenylethyl)-5,6,7,8-tetrahydroimidazo[1,2-*a*]pyridine-6,7,8-triol (75): A solution of **74** (145 mg, 0.27 mmol) in EtOH/AcOH (1:1, 4 mL) was stirred under H_2 (1 bar) at room temperature in the presence of $Pd(OH)_2$/C (185 mg) for 12 h. The suspension was centrifuged and the catalyst rinsed several times with hot MeOH. The combined organic solutions were concentrated to dryness in vacuo. The residue was dissolved in anhydrous CH_2Cl_2 (3.5 mL) and cooled to –78 °C. BCl_3 (1 M in CH_2Cl_2, 3.5 mL, 3.48 mmol) was added to the stirred reaction mixture, which after 1 h was placed in a freezer at –20 °C for 12 h, cooled again to –78 °C, quenched with MeOH (5 mL) and concentrated in vacuo. The residue was purified by flash chromatography (CH_2Cl_2/MeOH, 9:1) to give **75** (41 mg, 56%) as a yellowish oil. $[\alpha]_D^{20}$ = –46 (*c* = 0.5, MeOH).^{1}H NMR (400 MHz, CD_3OD): δ = 2.78–2.84, 2.87–2.92 (m, 4 H, CH_2CH_2Ph), 3.80 (dd, 1 H, H-5a), 3.86 (dd, 1 H, H-7), 4.01 (ddd, 1 H, H-6), 4.16 (dd, 1 H, H-5b), 4.53 (d, 1 H, H-8), 6.67 (s, 1 H, H-3), 7.10–7.24 (m, 5 H, CH arom.) ppm; $J_{5a,6}$ = 6.8, $J_{5b,6}$

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= 4.6, $J_{5a,5b}$ = 12.8, $J_{6,7}$ = 7.6, $J_{7,8}$ = 5.6 Hz. ^{13}C NMR (100.6 MHz, CD_3OD): δ = 31.0 (CH_2CH_2Ph), 36.7 (CH_2CH_2Ph), 49.1 (C-5), 68.8 (C-6), 69.3 (C-8), 75.1 (C-7), 116.5 (C-3), 126.9, 129.3, 129.4 (*C*H of phenyl), 142.7, 143.1 (C-2, $C_{quat.}$ of phenyl), 146.1 (C-8a) ppm. HR-MS: calcd. for $[M + H]^+$ ($C_{15}H_{19}N_2O_3$) 275.1390; found 275.1392.

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