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FOR CHEMICAL ECOLOGY

Article

Biosynthesis of strychnine

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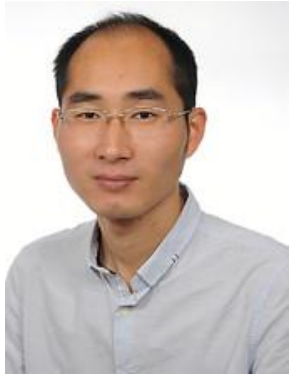
Benke Hong[1], Dagny Grzech[1], Lorenzo Caputi[1], Prashant Sonawane[1], Carlos E. Rodríguez López[1], Mohamed Omar Kamileen[1], Néstor J. Hernández Lozada[1], Veit Grabe[2] & Sarah E. O'Connor[1]✉



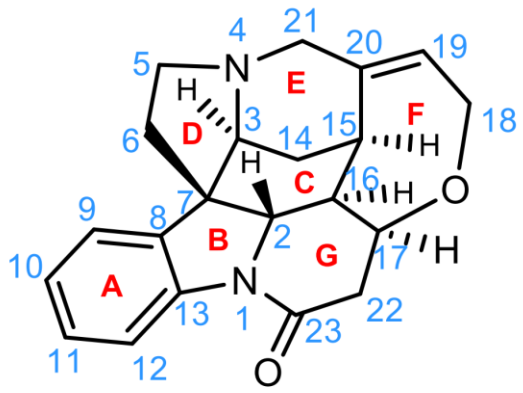
Benke, Hong

Sarah E. O'Connor

Yongle Luo

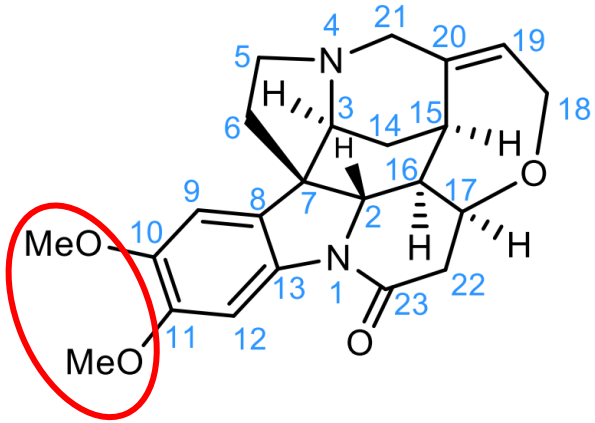
01/14/2023

Strychnine

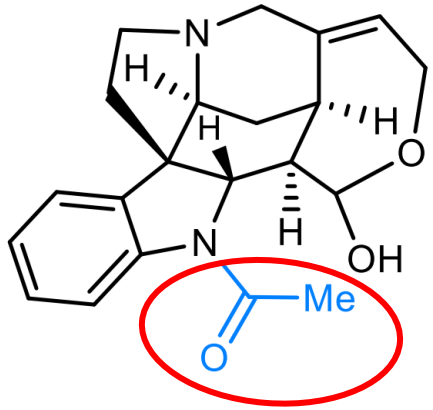


Strychnine 10
士的宁

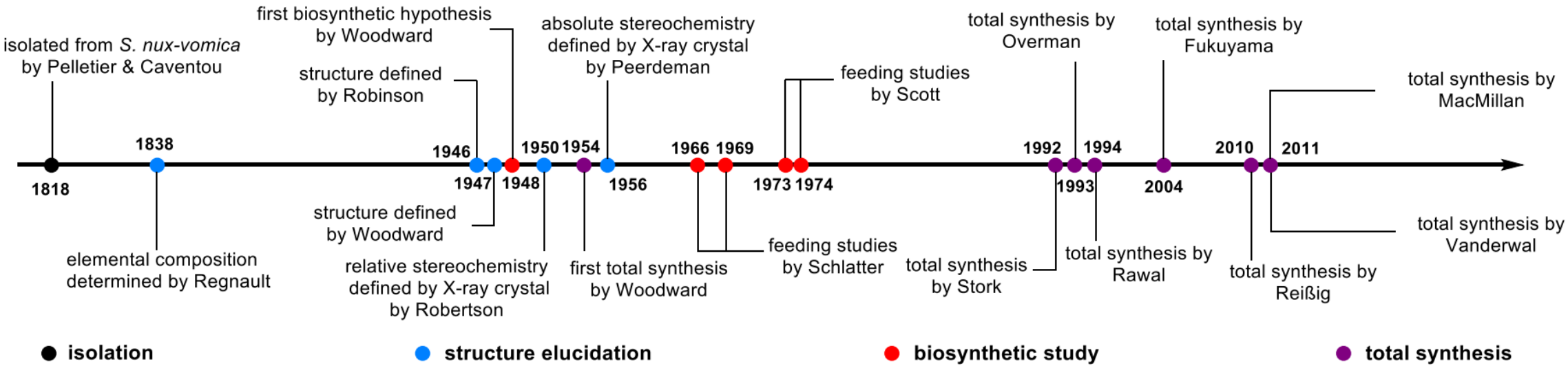
Seeds of *S. nux-vomica*
马钱子的种子



Brucine 15

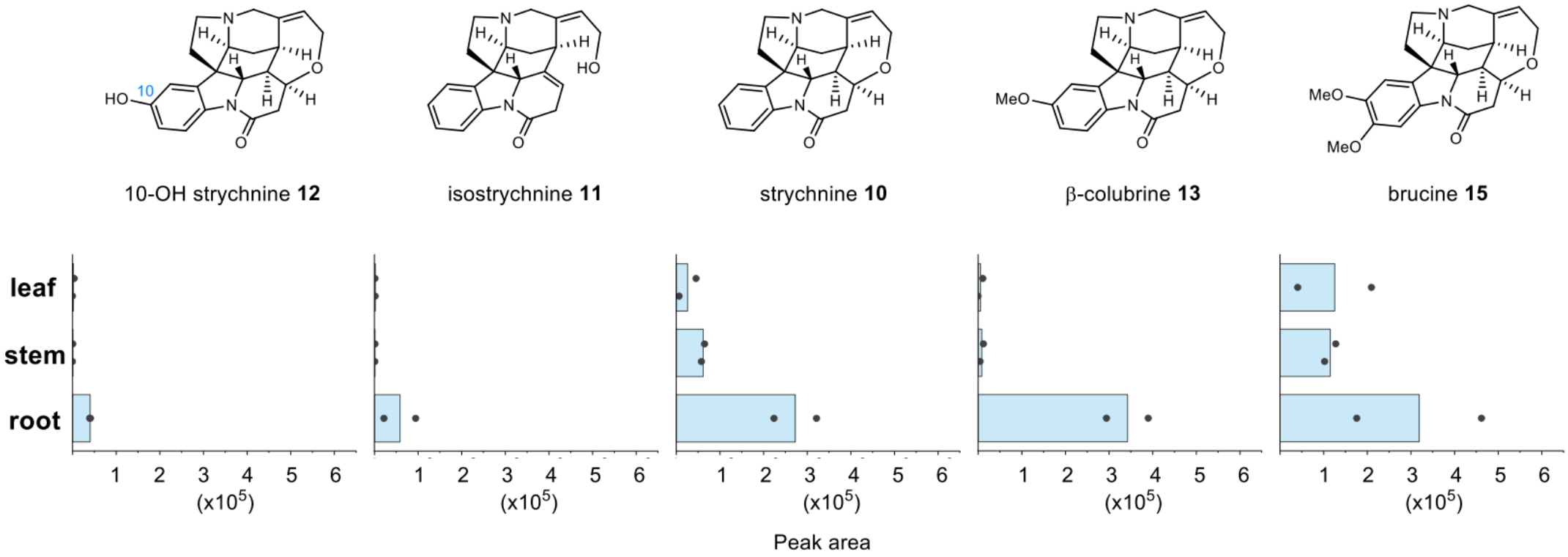


Diaboline 8

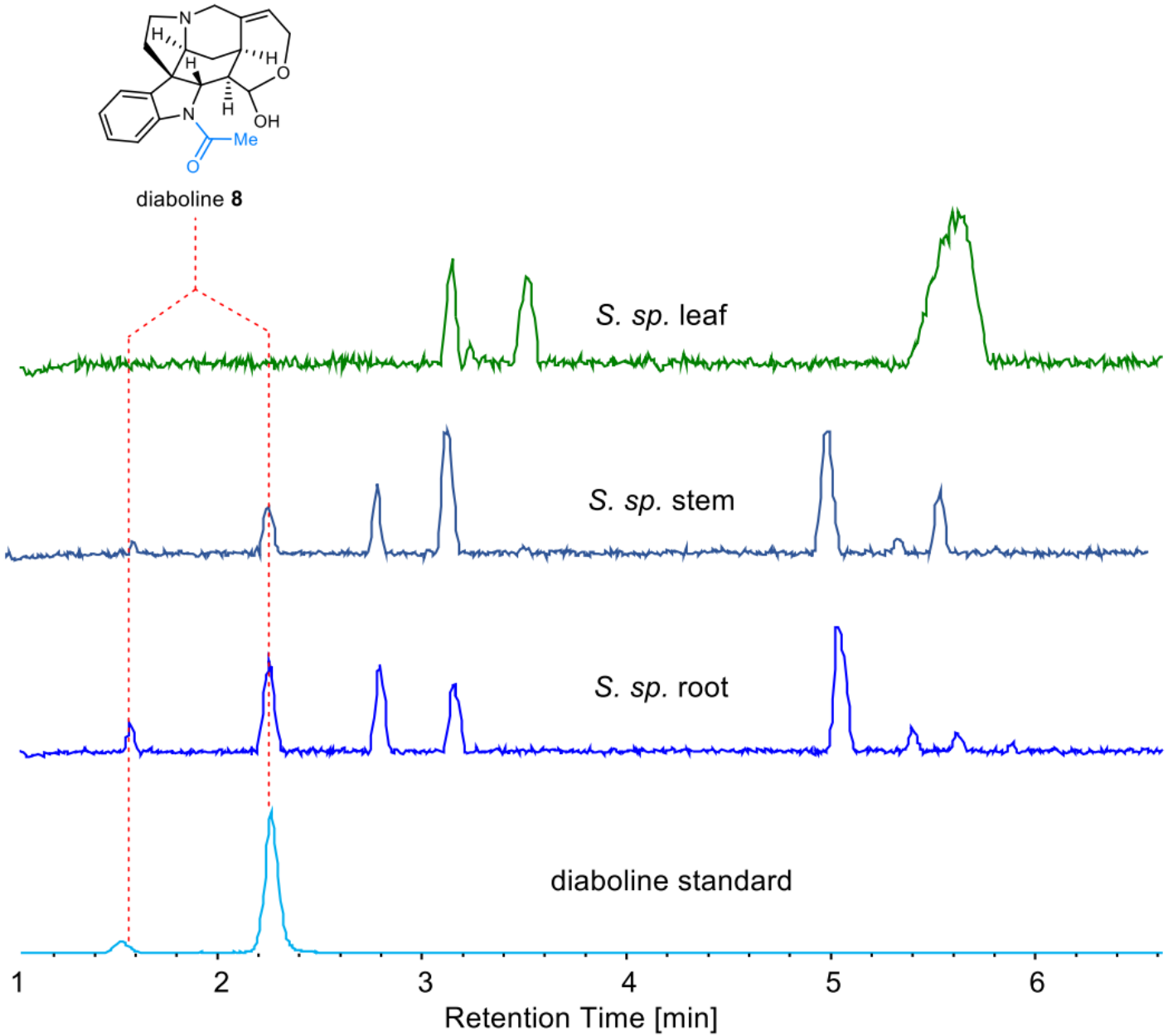


Brief timeline of strychnine research

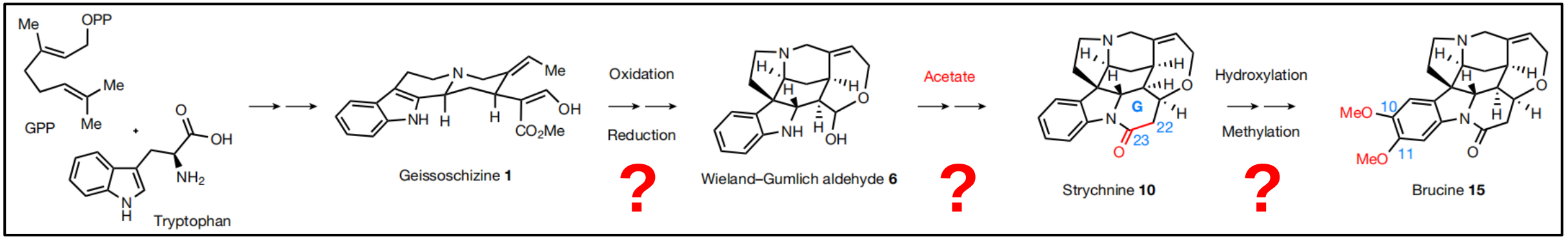
Metabolic analysis of S. *nux-vomica*



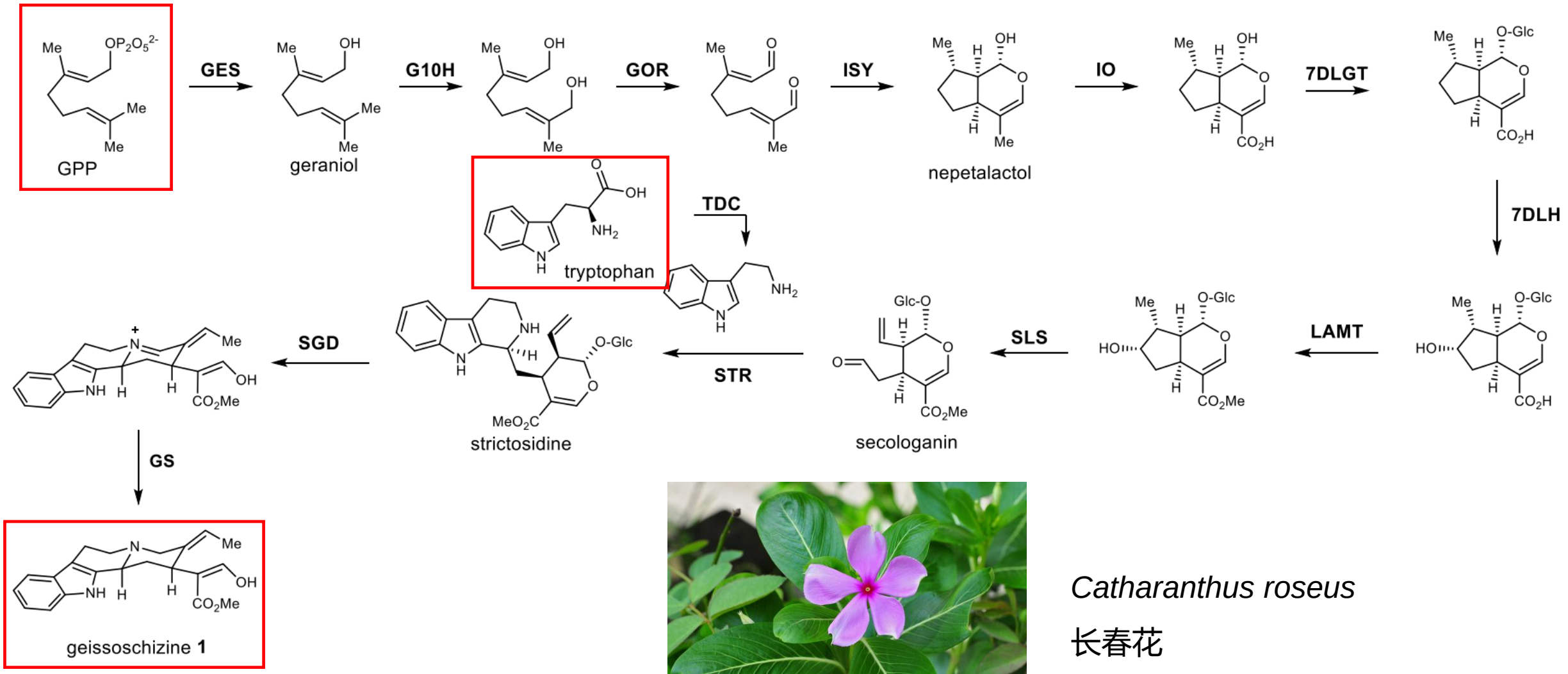
Metabolic analysis of *Strychnos* sp.



Previous feeding studies



From tryptophan and GPP to geissoschizine 1

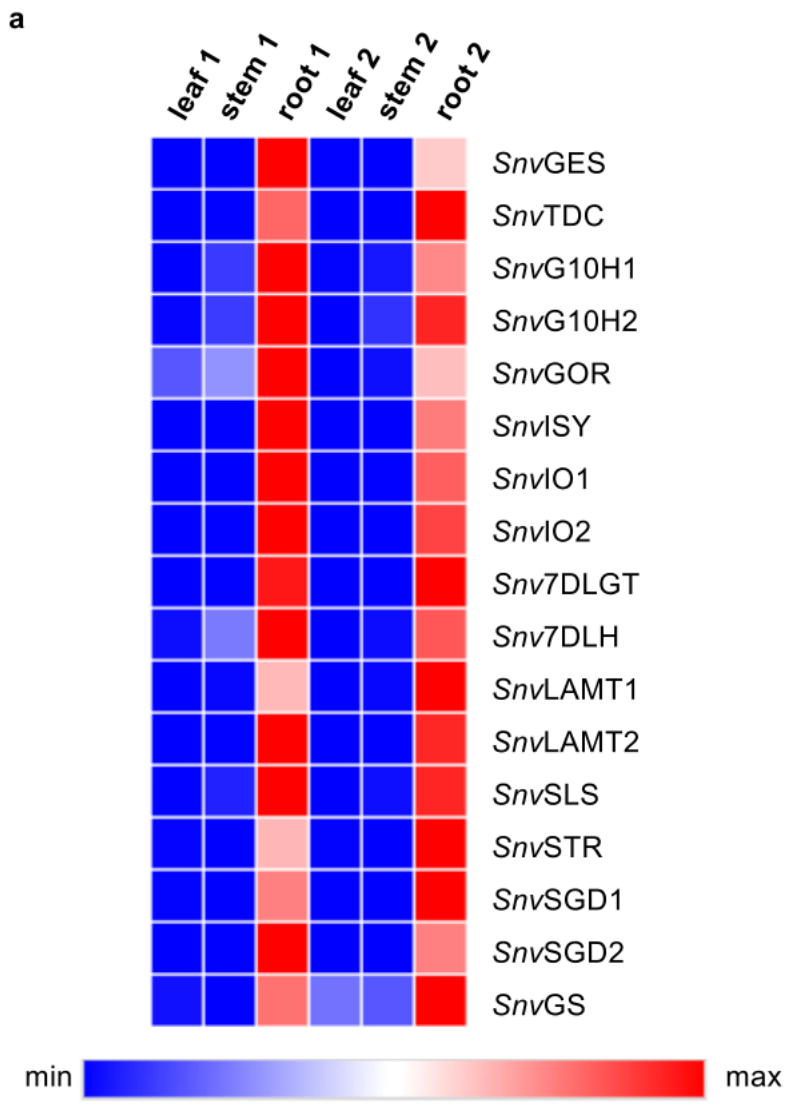


Catharanthus roseus

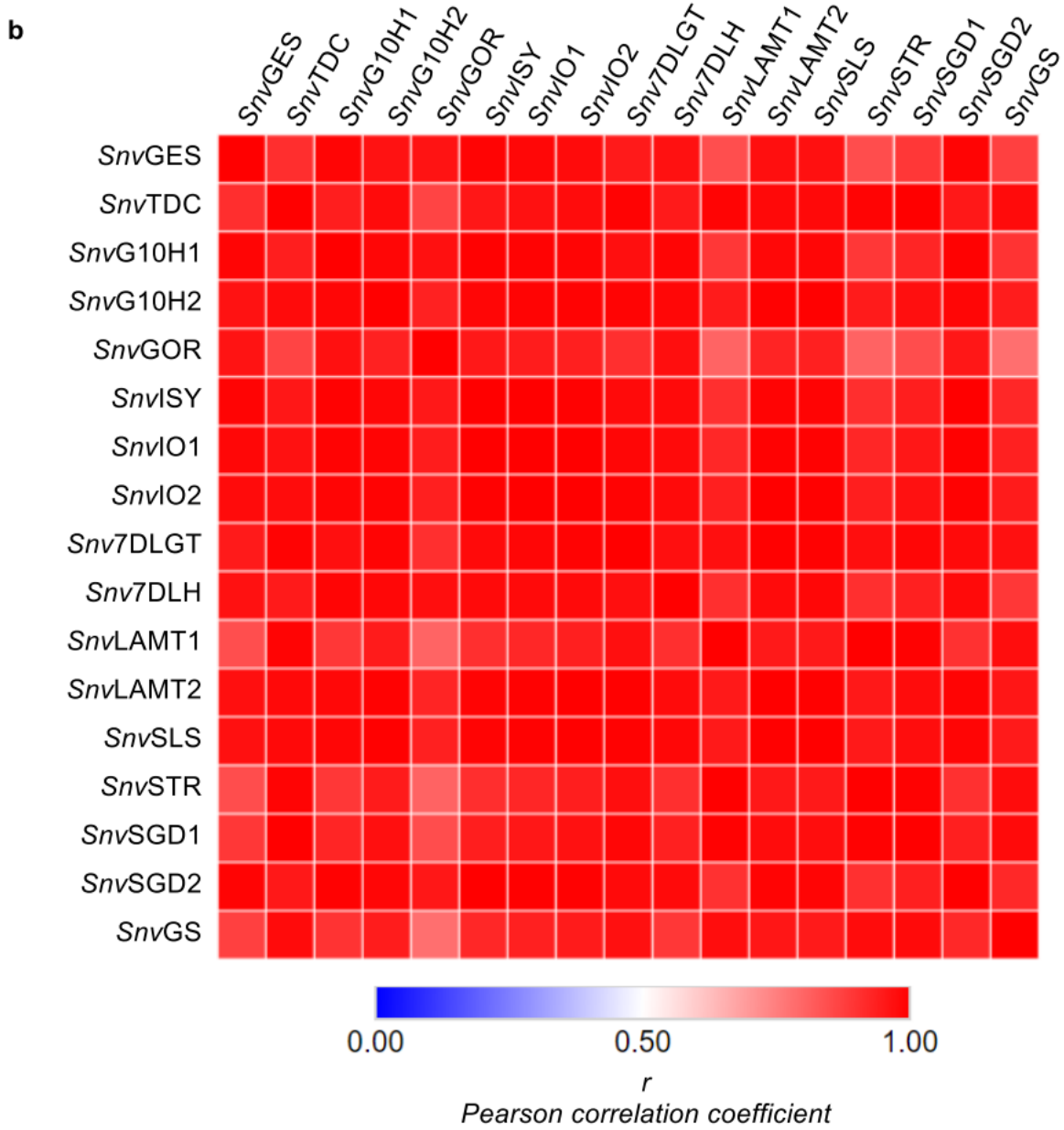
长春花

From tryptophan and GPP to geissoschizine 1

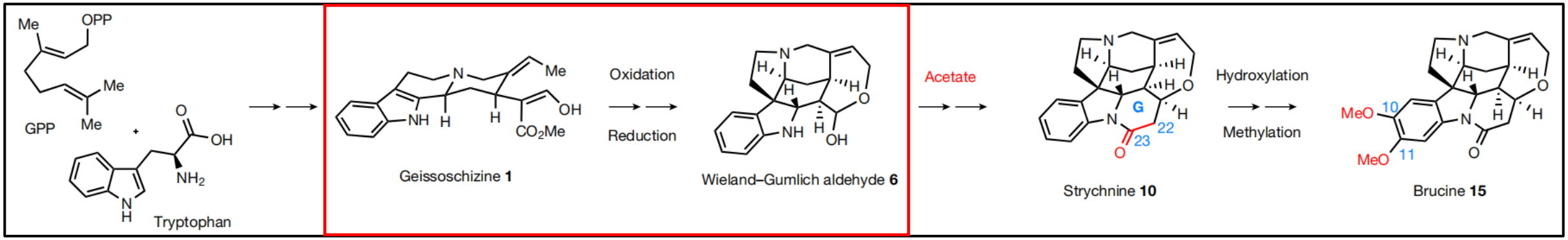
Expression profiles of candidate genes



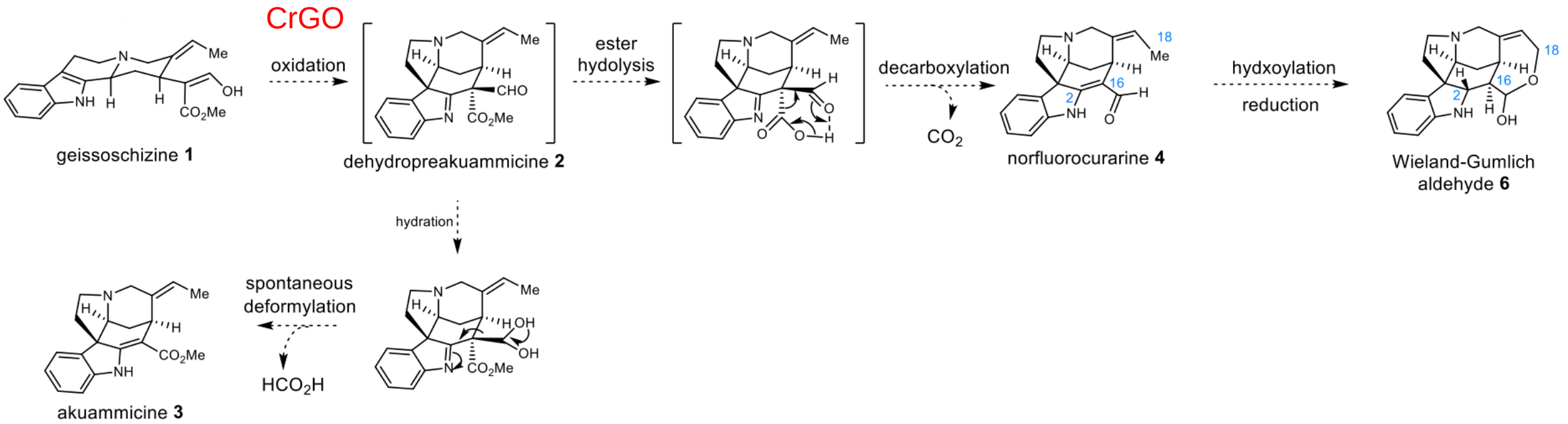
Coexpression analysis of candidate genes



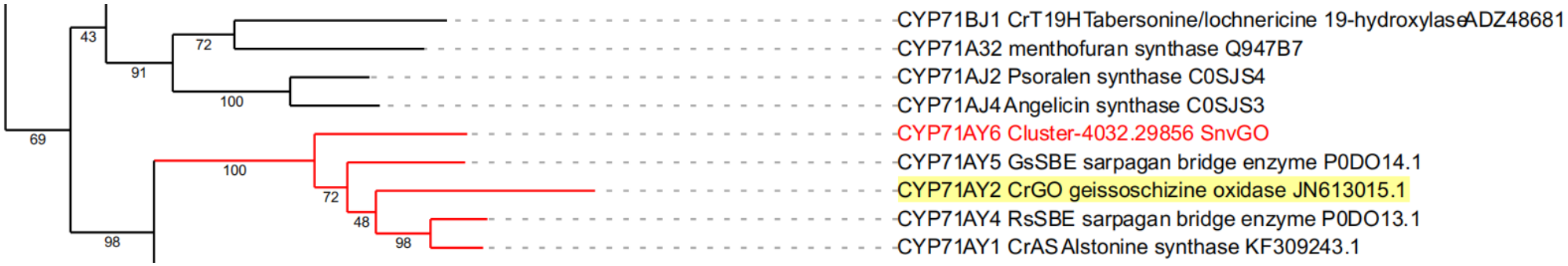
The proposed biosynthesis pathway for strychnine and brucine

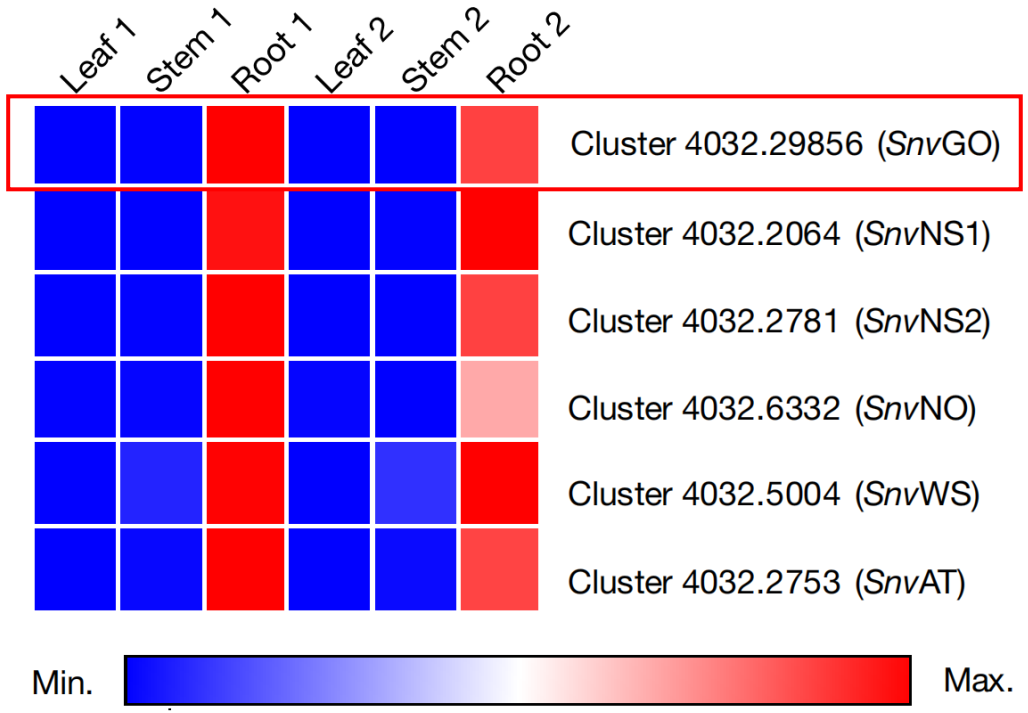


From geissoschizine 1 to dehypreakummicine 2



From geissoschizine 1 to dehypreakummicine 2

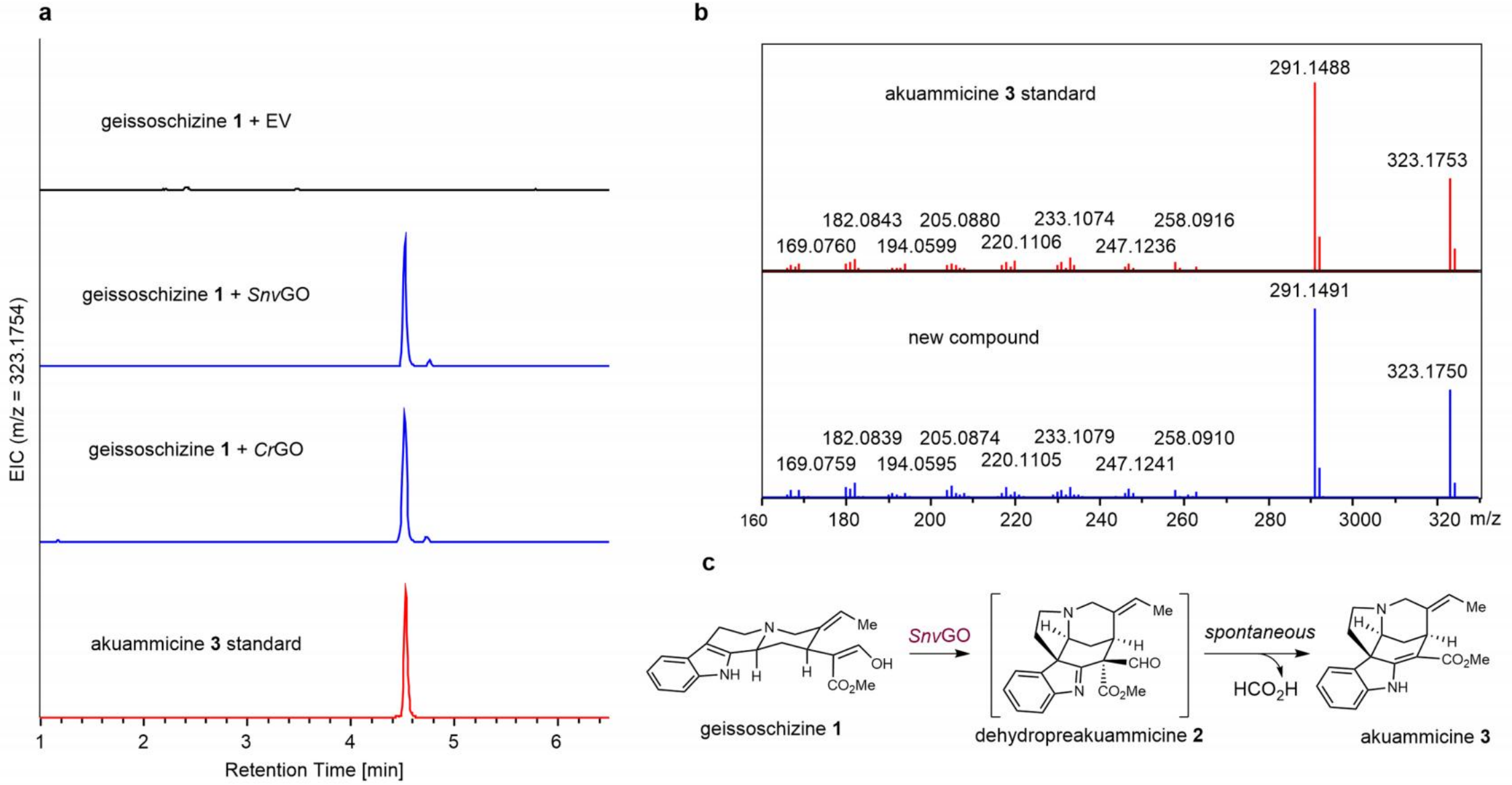




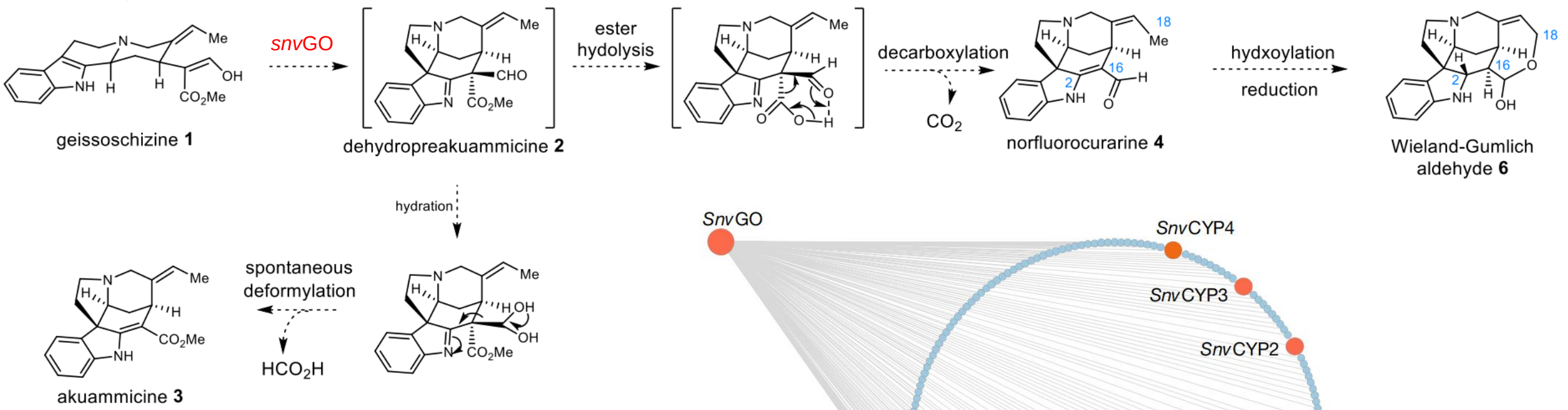
N. Benthamiana
本氏烟草

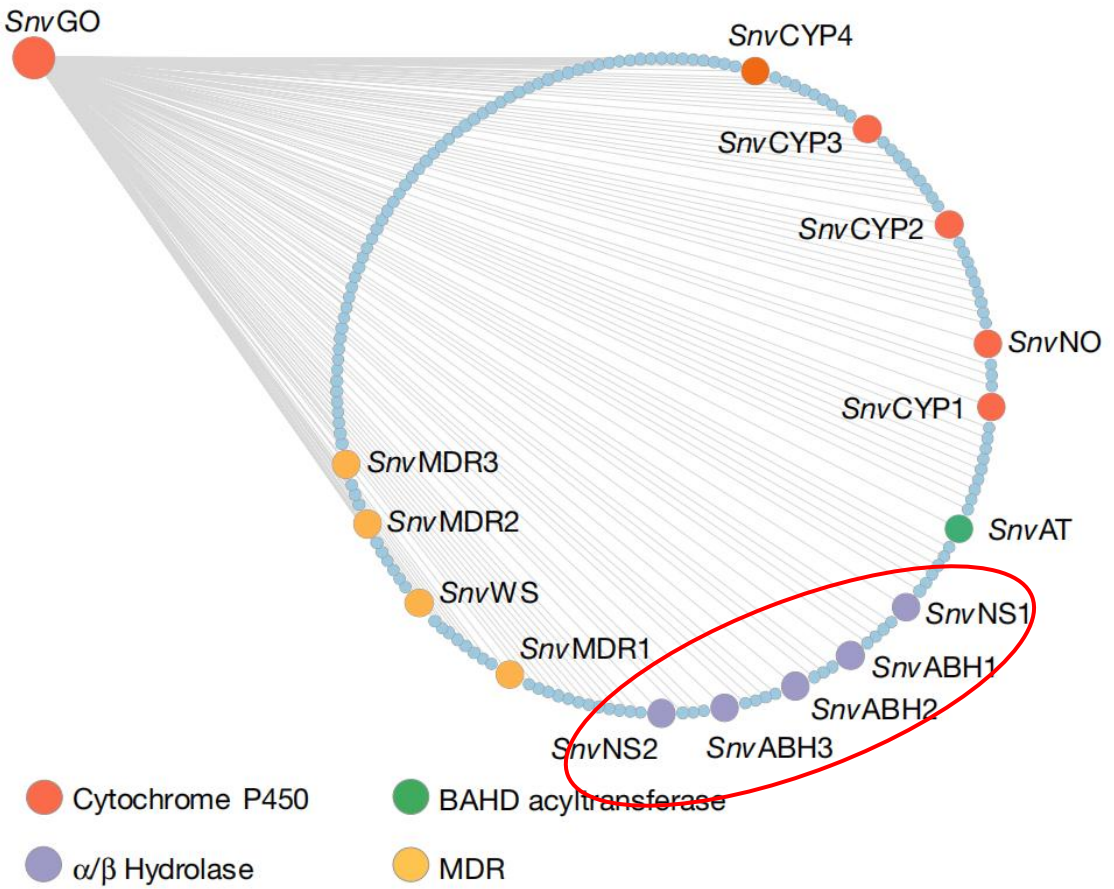
Agrobacterium tumefaciens-mediated transient expression

From geissoschizine 1 to dehypreakummicine 2

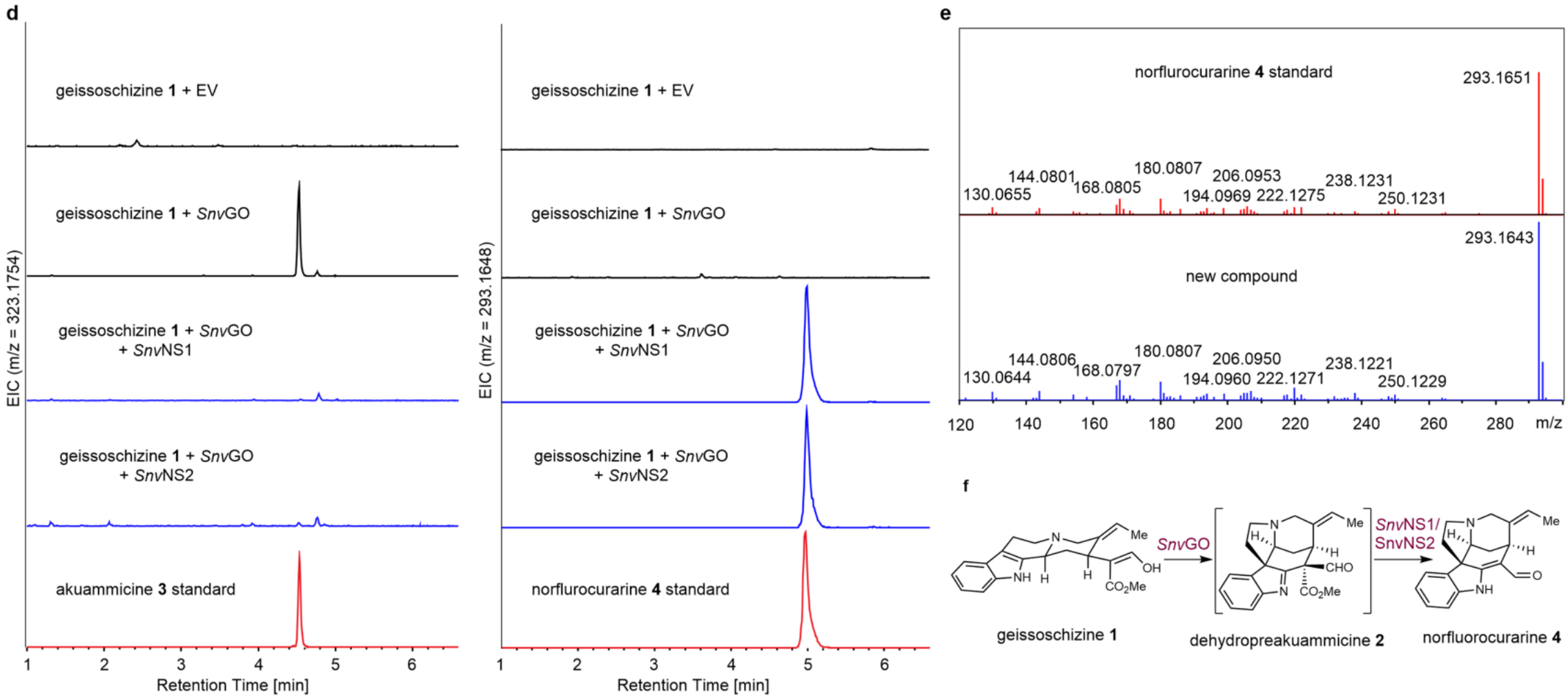


From geissoschizine 1 to norfluorocurarine 4



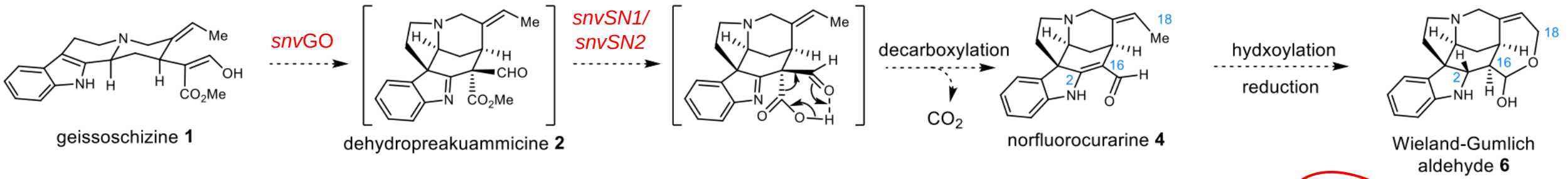


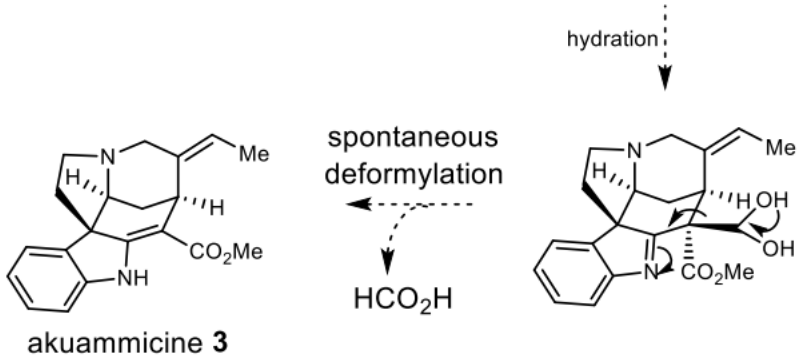
From geissoschizine 1 to norfluorocurarine 4

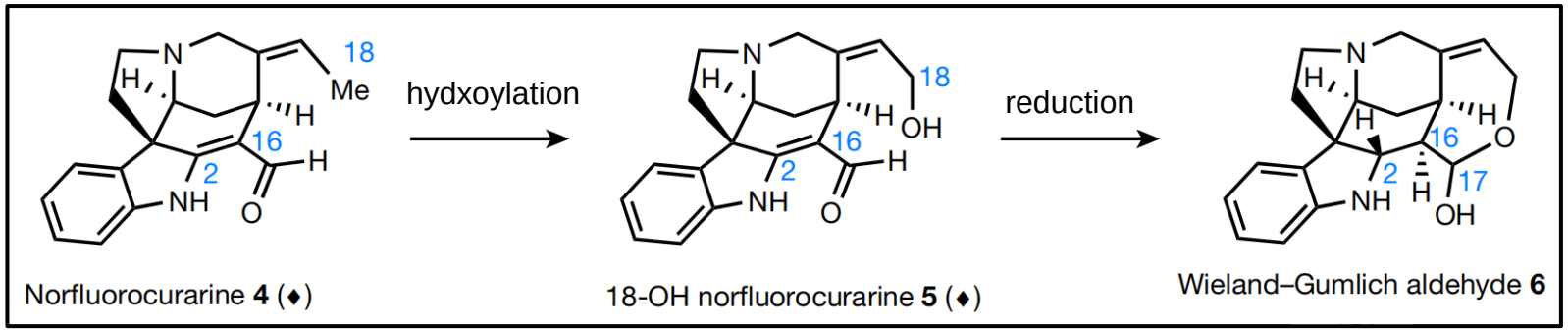


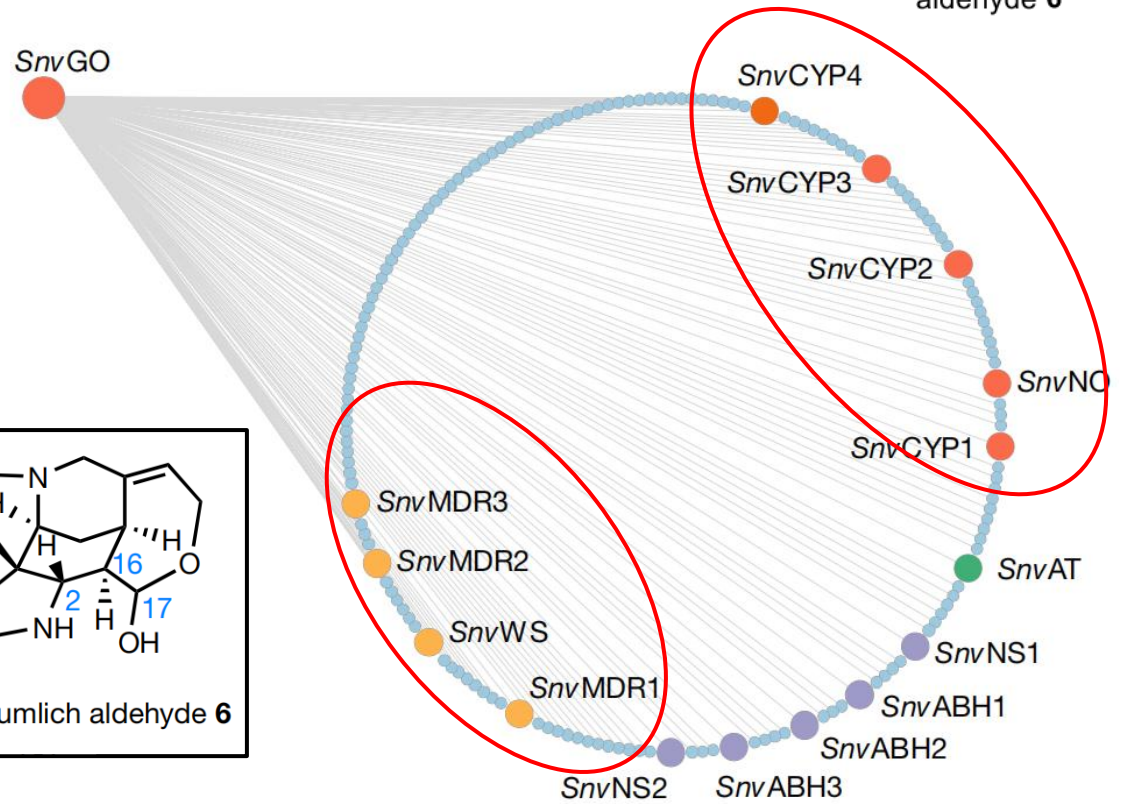
*snv*NS1 and *snv*SN2 led to production of 4 and substantially decreased levels of 3

From geissoschizine 1 to Weiland-Gumlich aldehyde 6

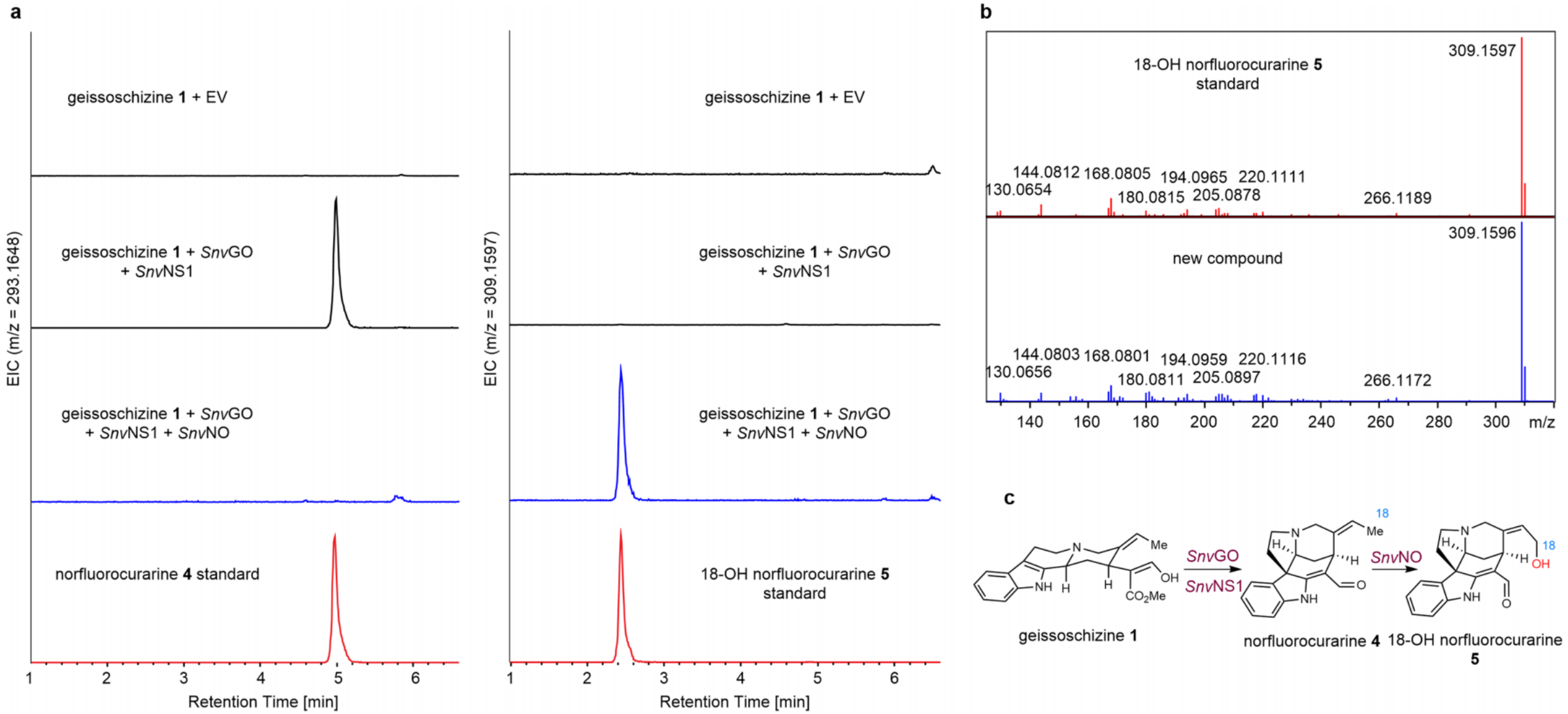




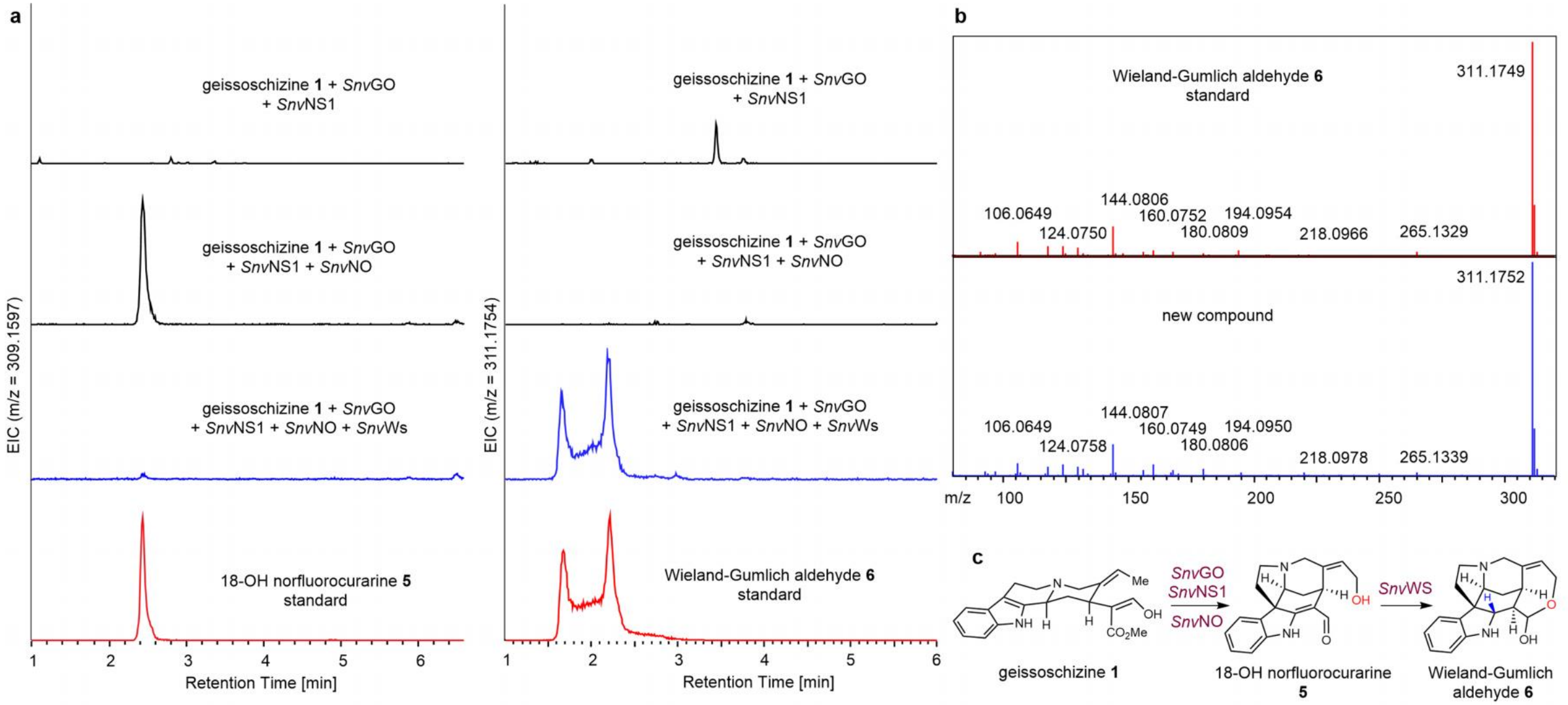




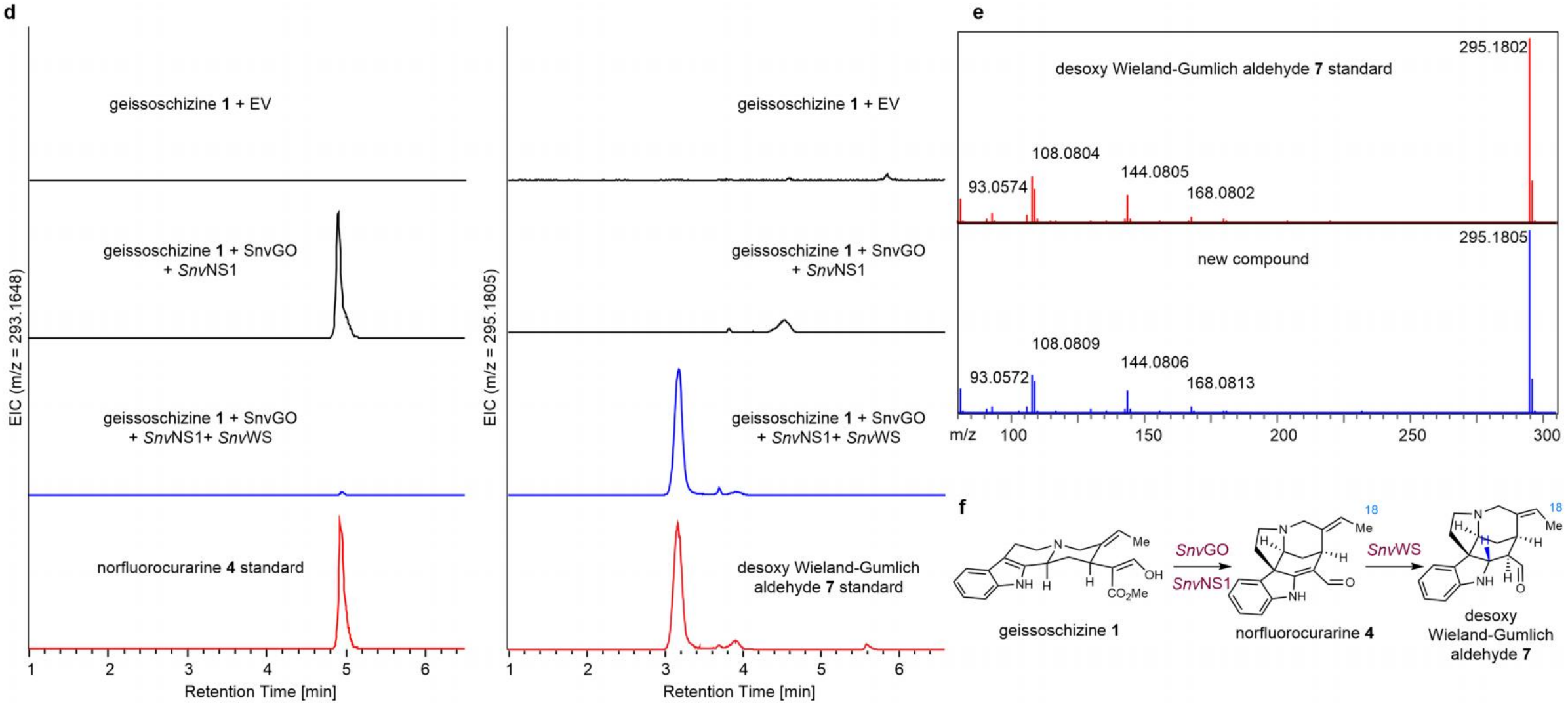
From geissoschizine 1 to Weiland-Gumlich aldehyde 6



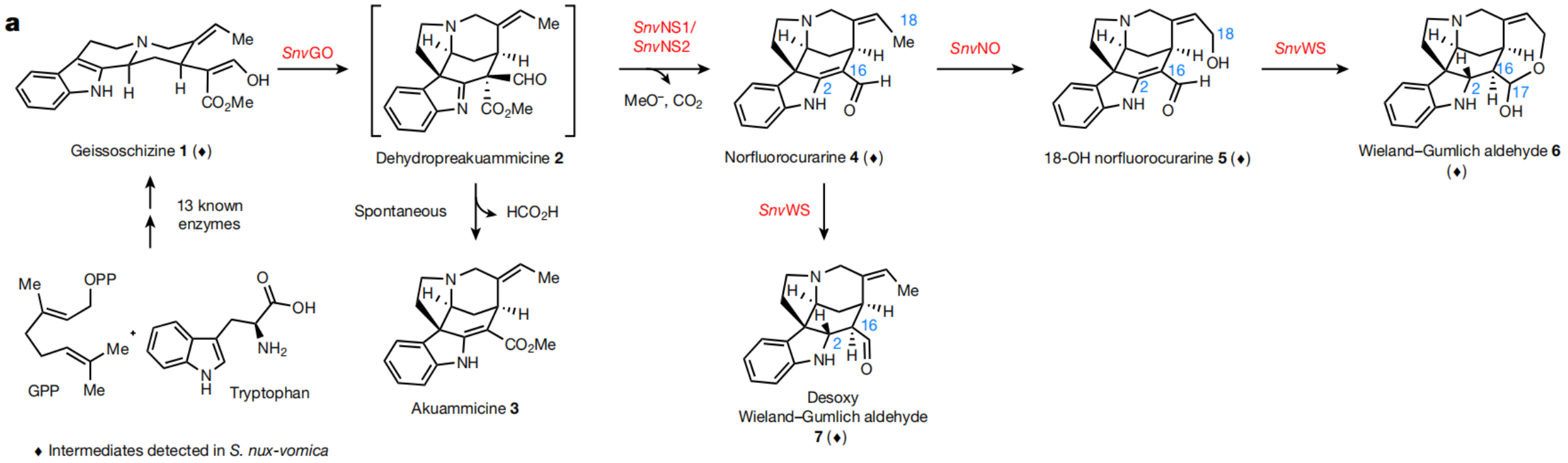
From geissoschizine 1 to Weiland-Gumlich aldehyde 6



From geissoschizine 1 to Weiland-Gumlich aldehyde 6

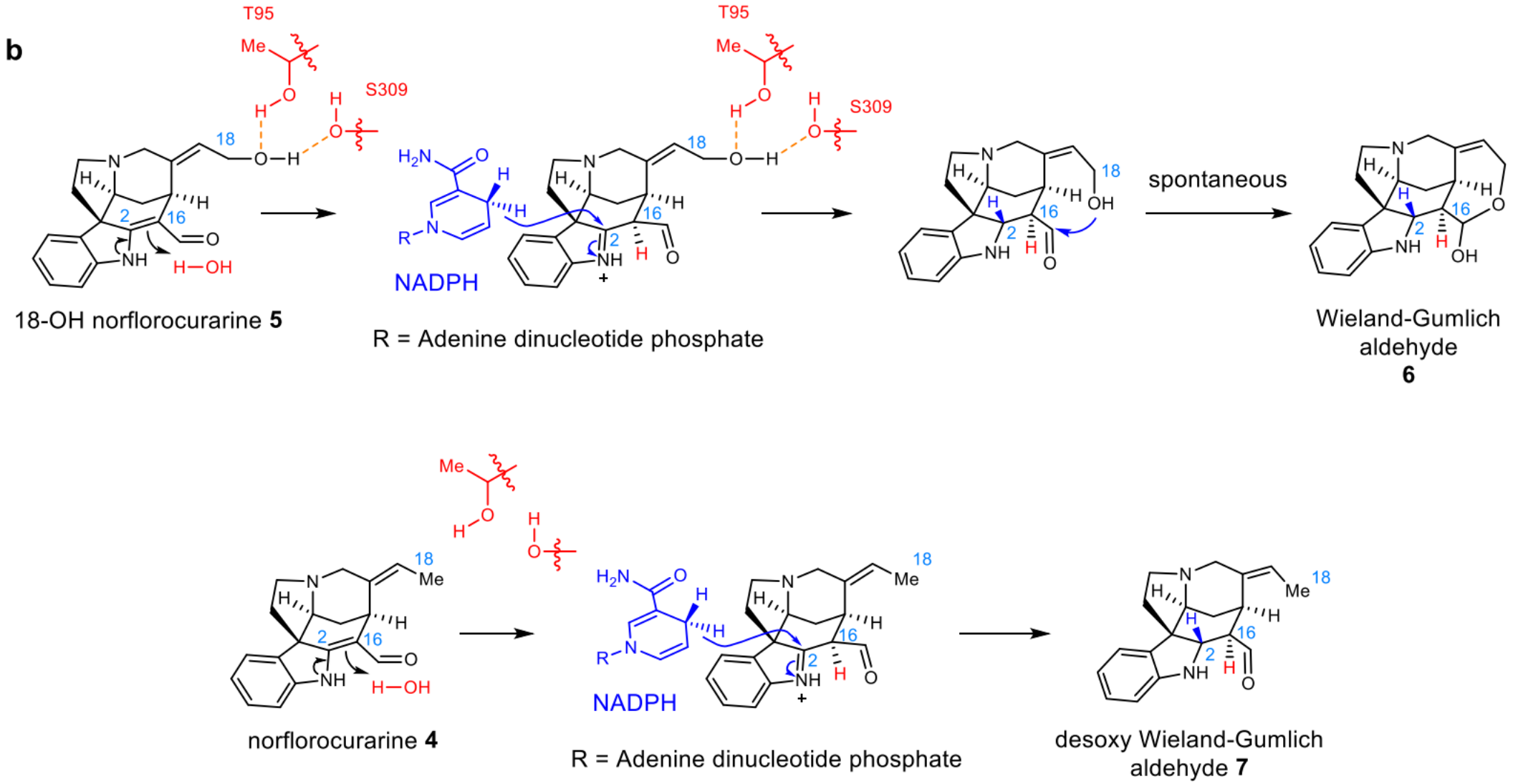


From geissoschizine 1 to Weiland-Gumlich aldehyde 6



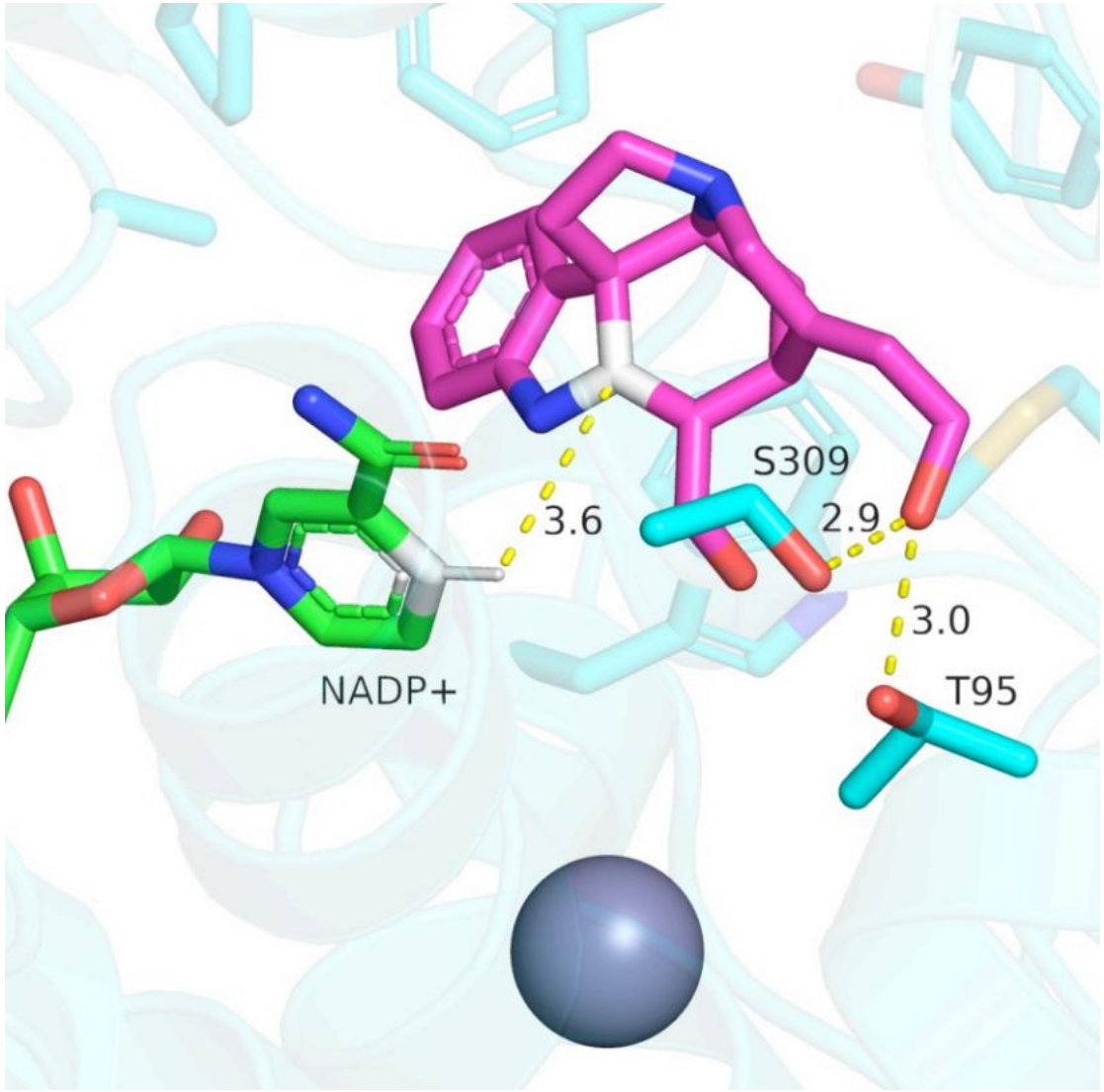
The order of the reactions is first oxidation to form 18-OH norfluorocurarine 5, followed by reduction.

Mechanistic hypothesis for SnvWS



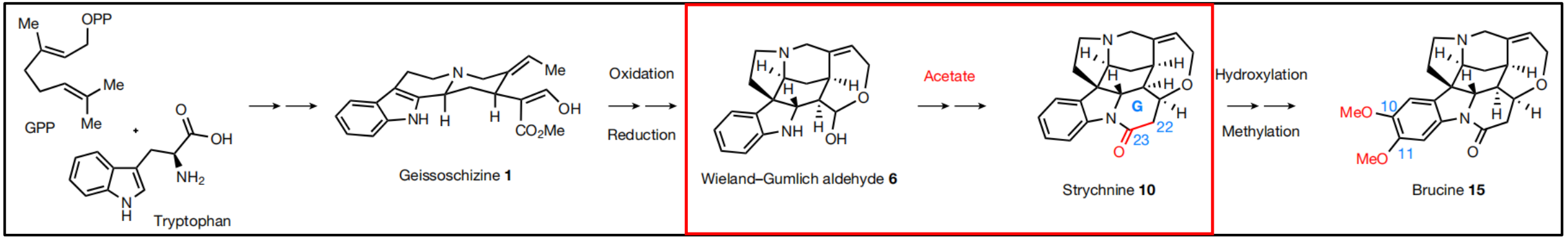
Proposed mechanism for the stereoselective formation of C2 and C16 chiral center in 6 and 7

Mechanistic hypothesis for SnvWS

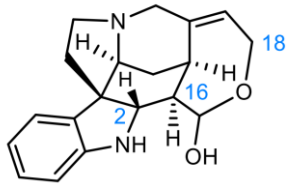


Docking model of *Snv*WS with 18-OH norflurocurarine **5**

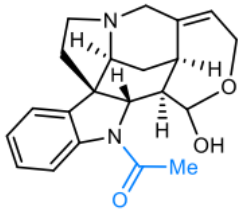
The proposed biosynthesis pathway for strychnine and brucine



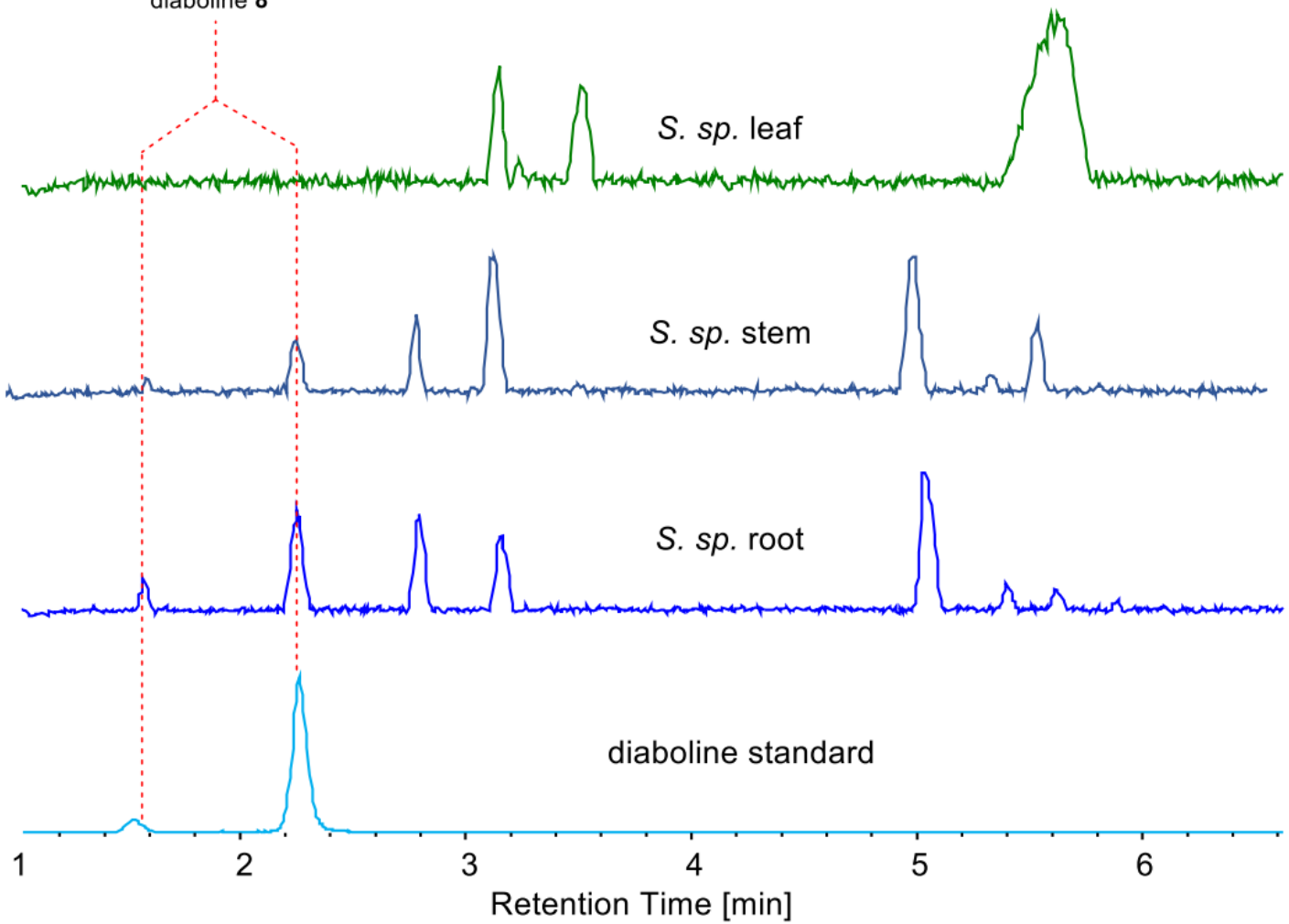
Metabolic analysis of *Strychnos* sp.



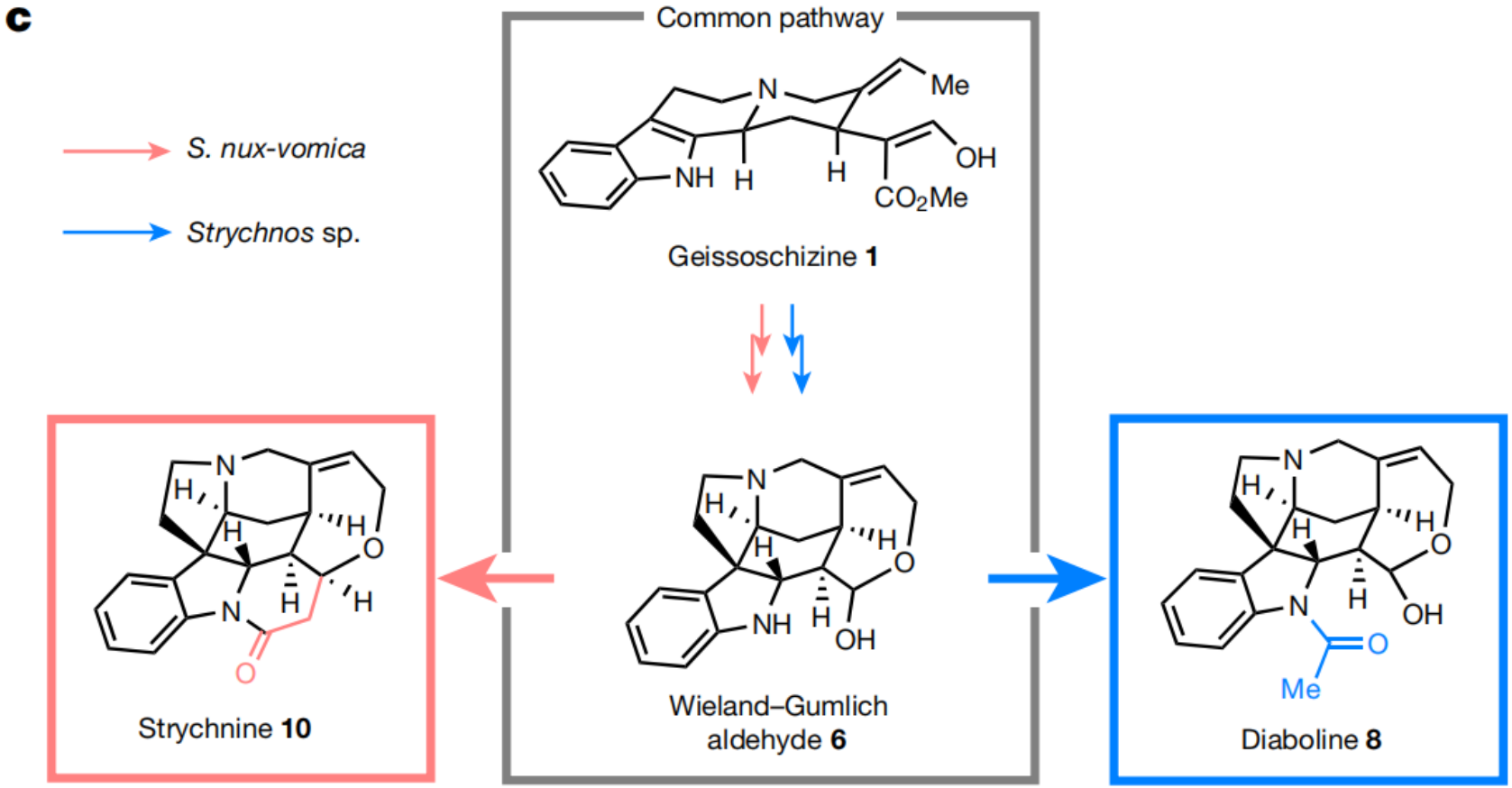
Wieland-Gumlich aldehyde **6**



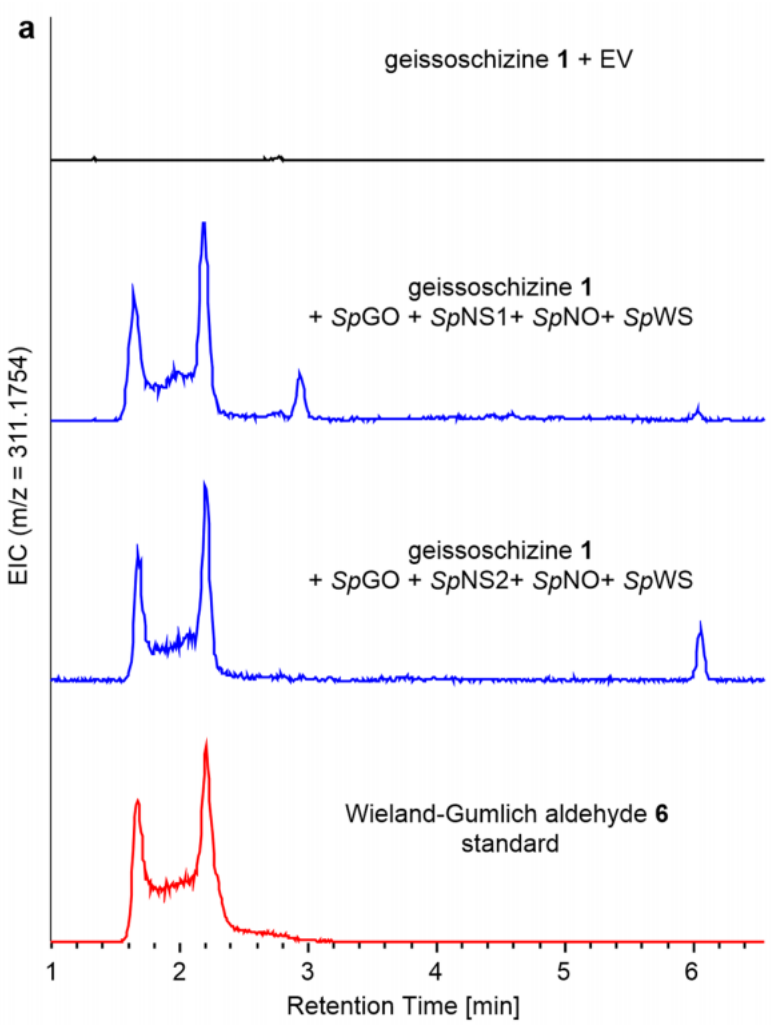
diaboline **8**

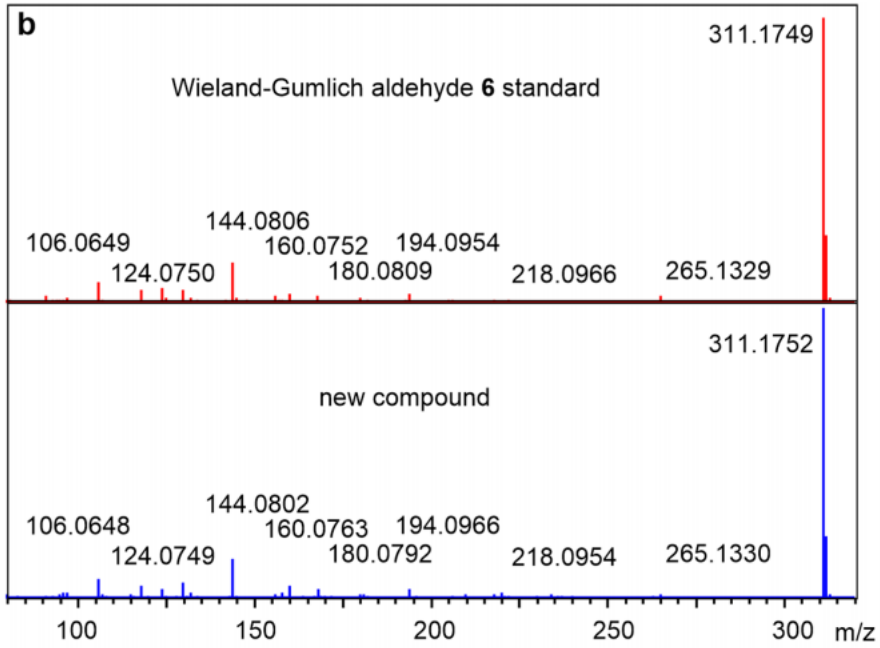


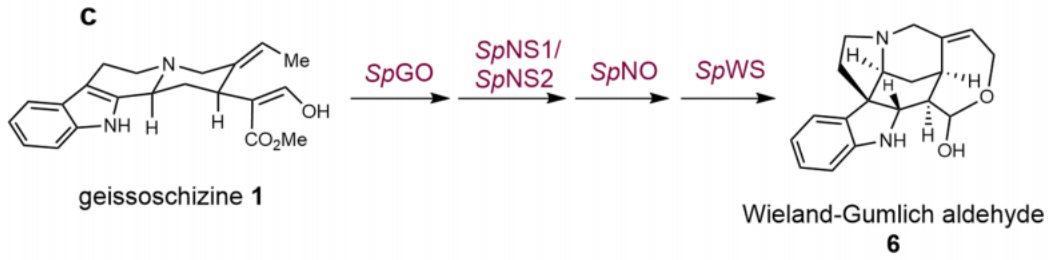
Snv. and sp. share a common pathway from 1 to 6



S. *nux-vomica* and *Strychnos* sp. share the same biosynthesis pathway from 1 to 6



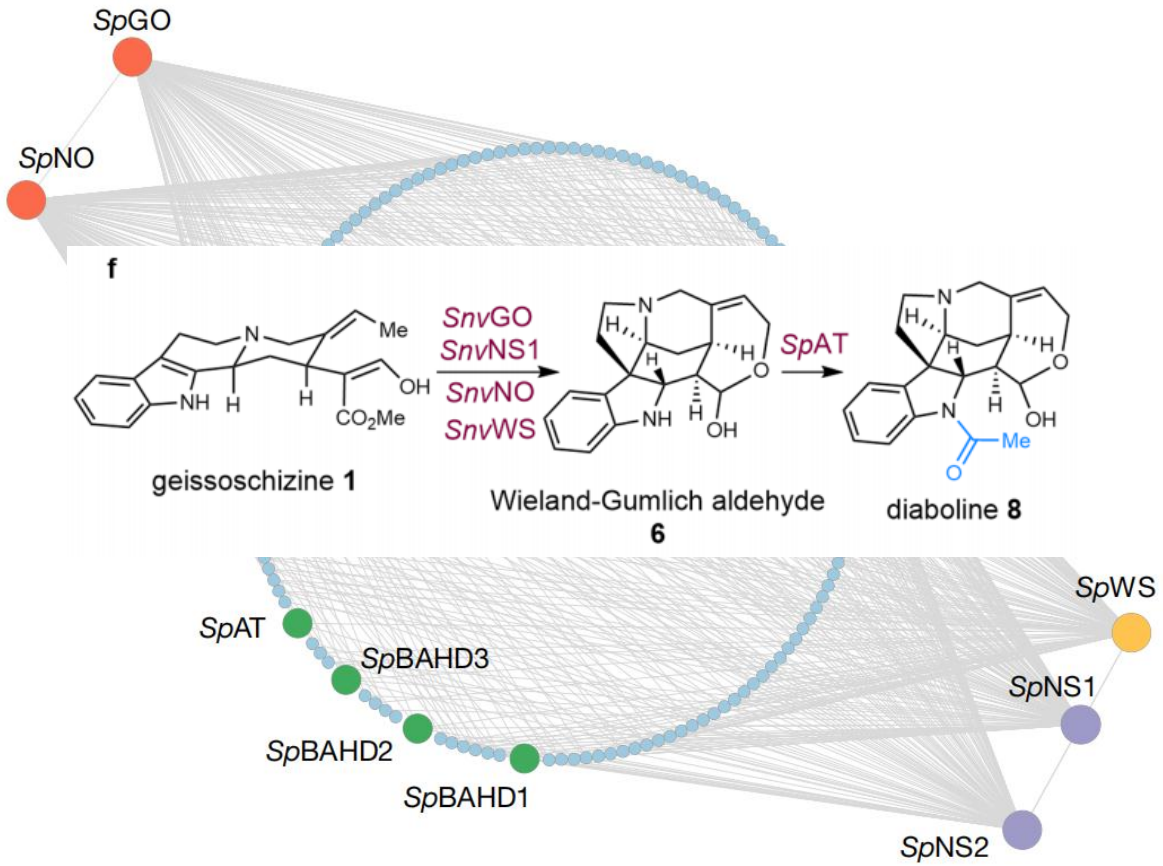


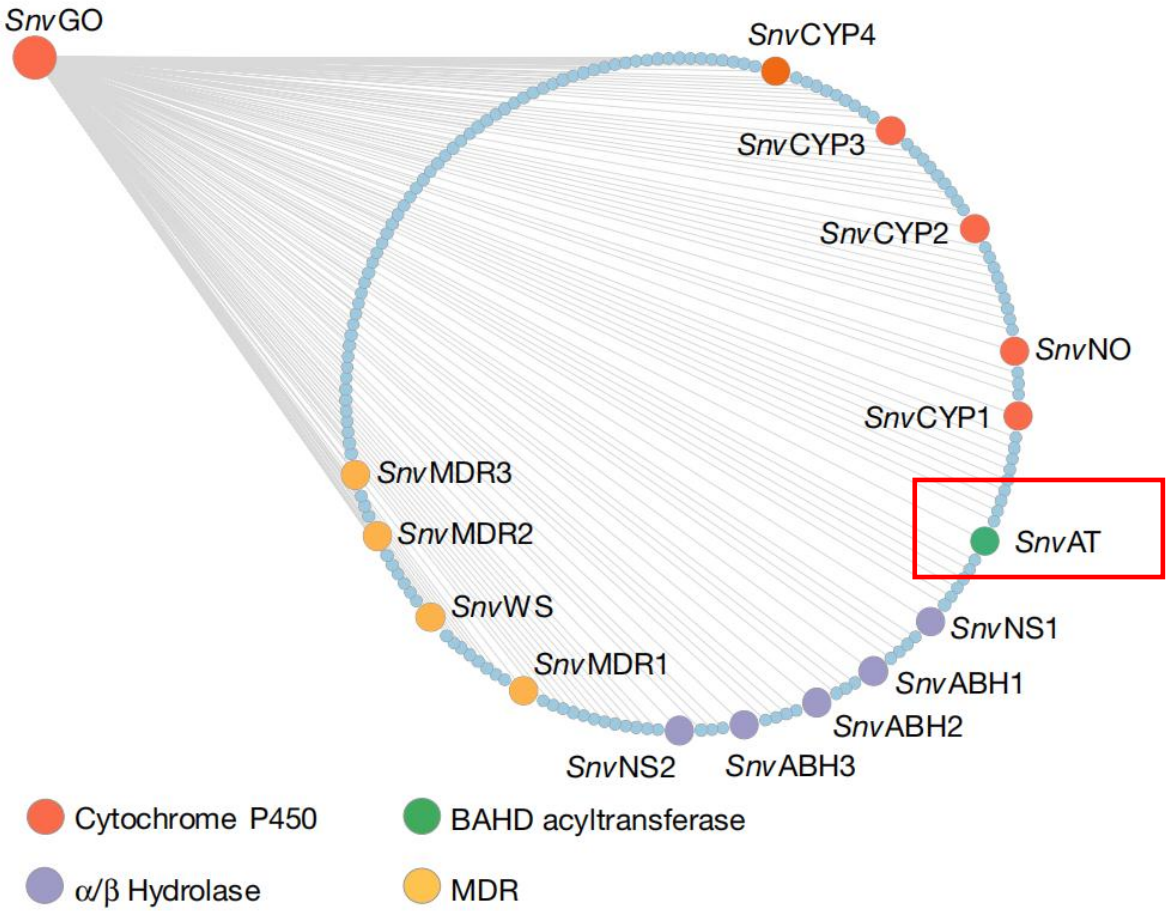


geissoschizine **1**

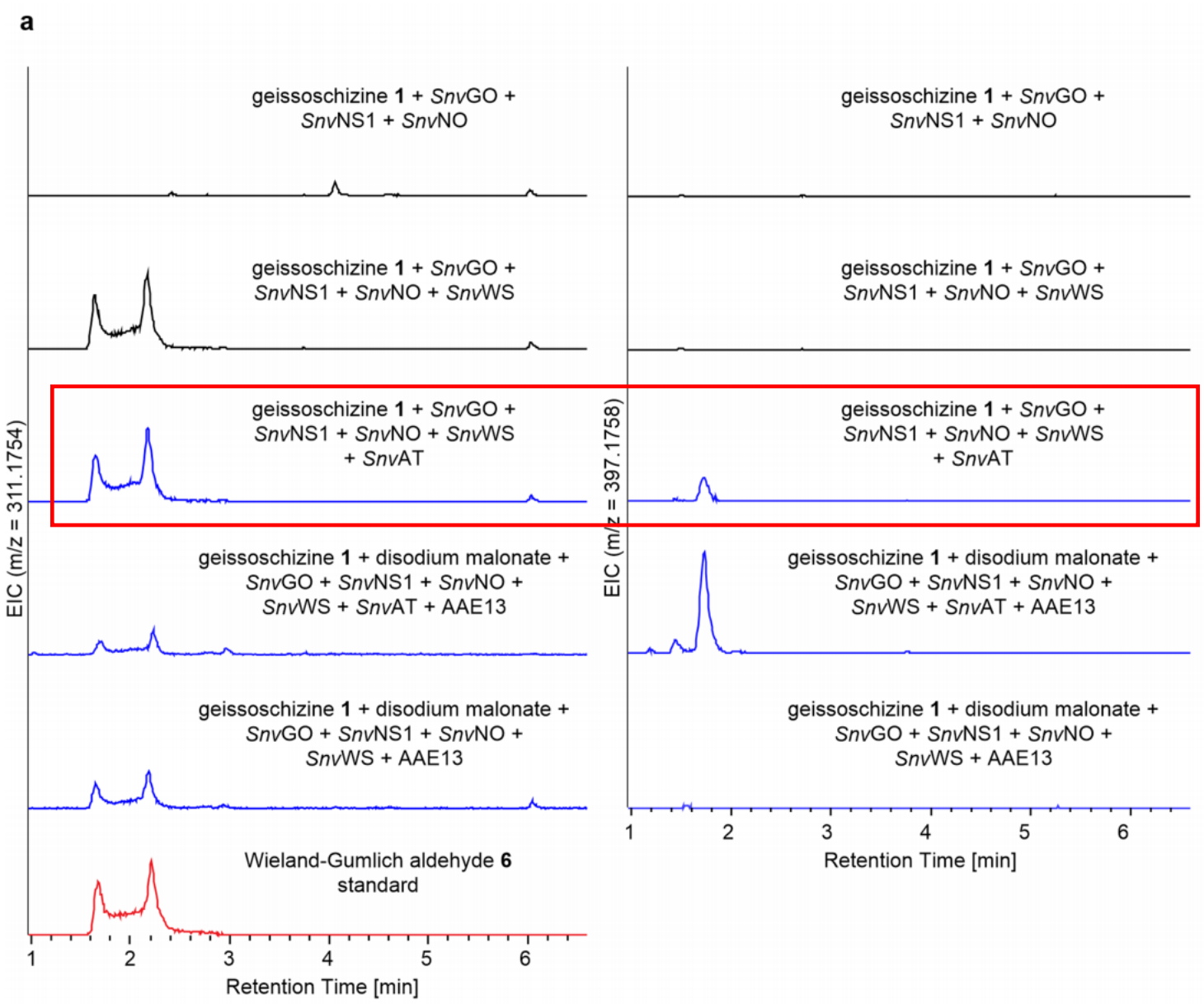
Wieland-Gumlich aldehyde **6**

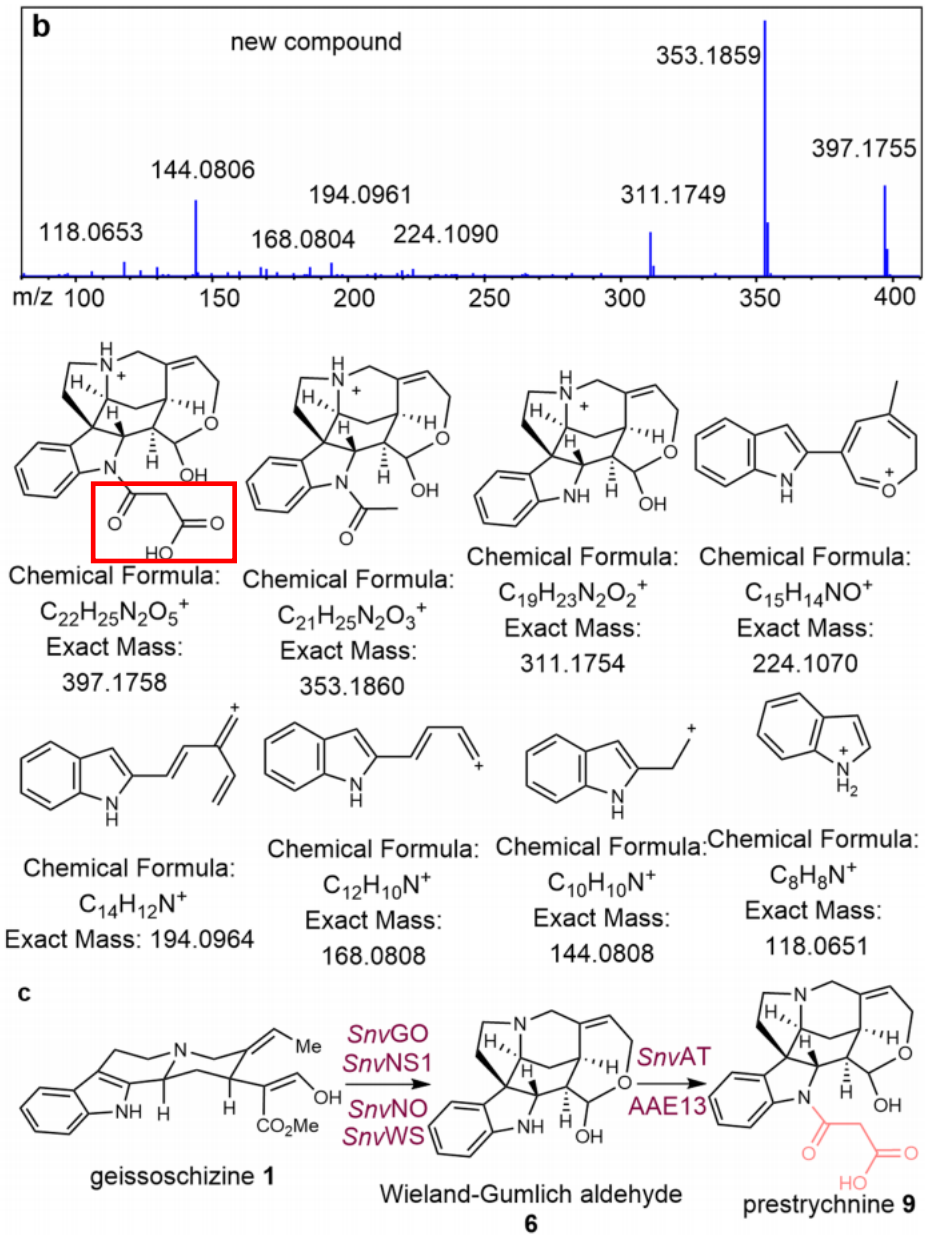
From Weiland-Gumlich aldehyde 6 to diaboline 8



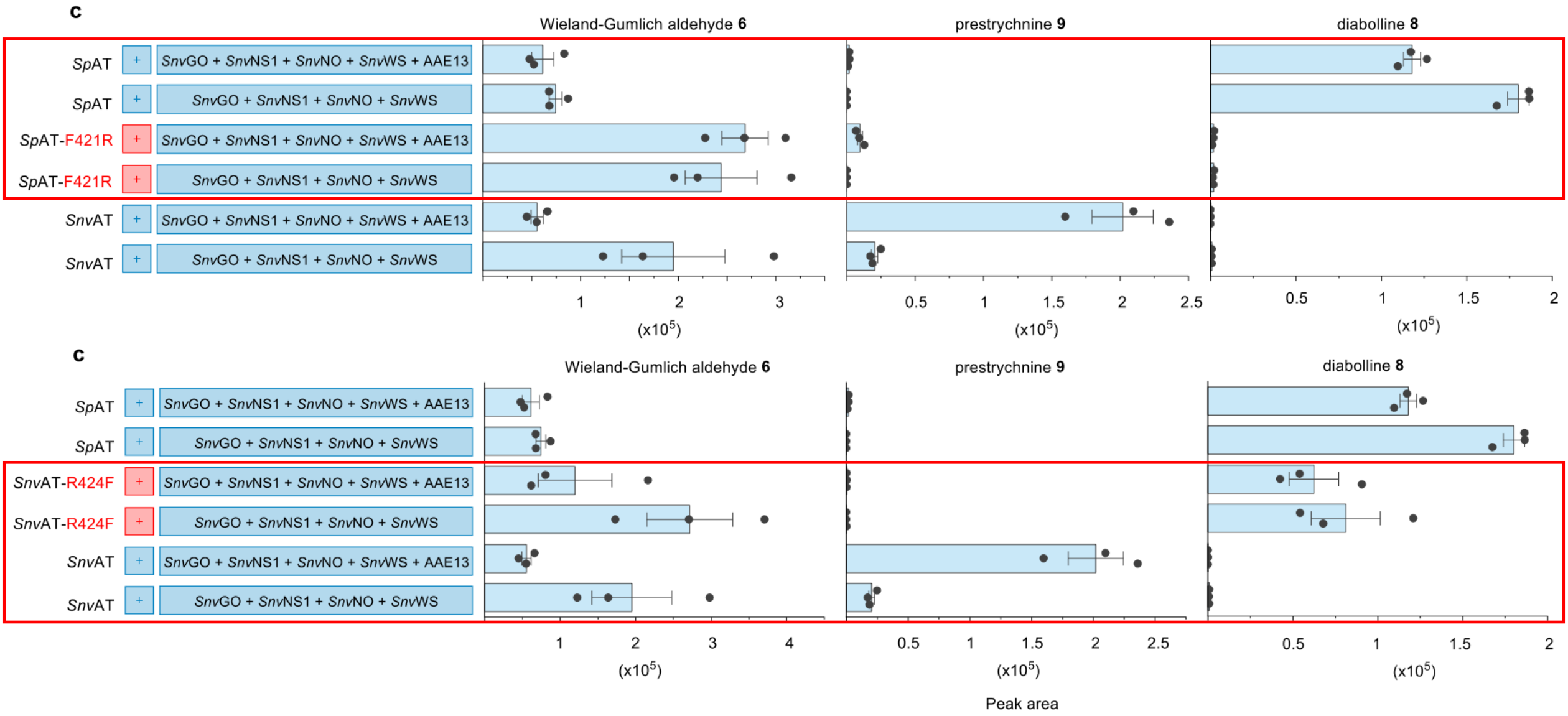


From Weiland-Gumlich aldehyde 6 to prestrychnine 9





Arginine residue is responsible for the malonyl-CoA selectivity



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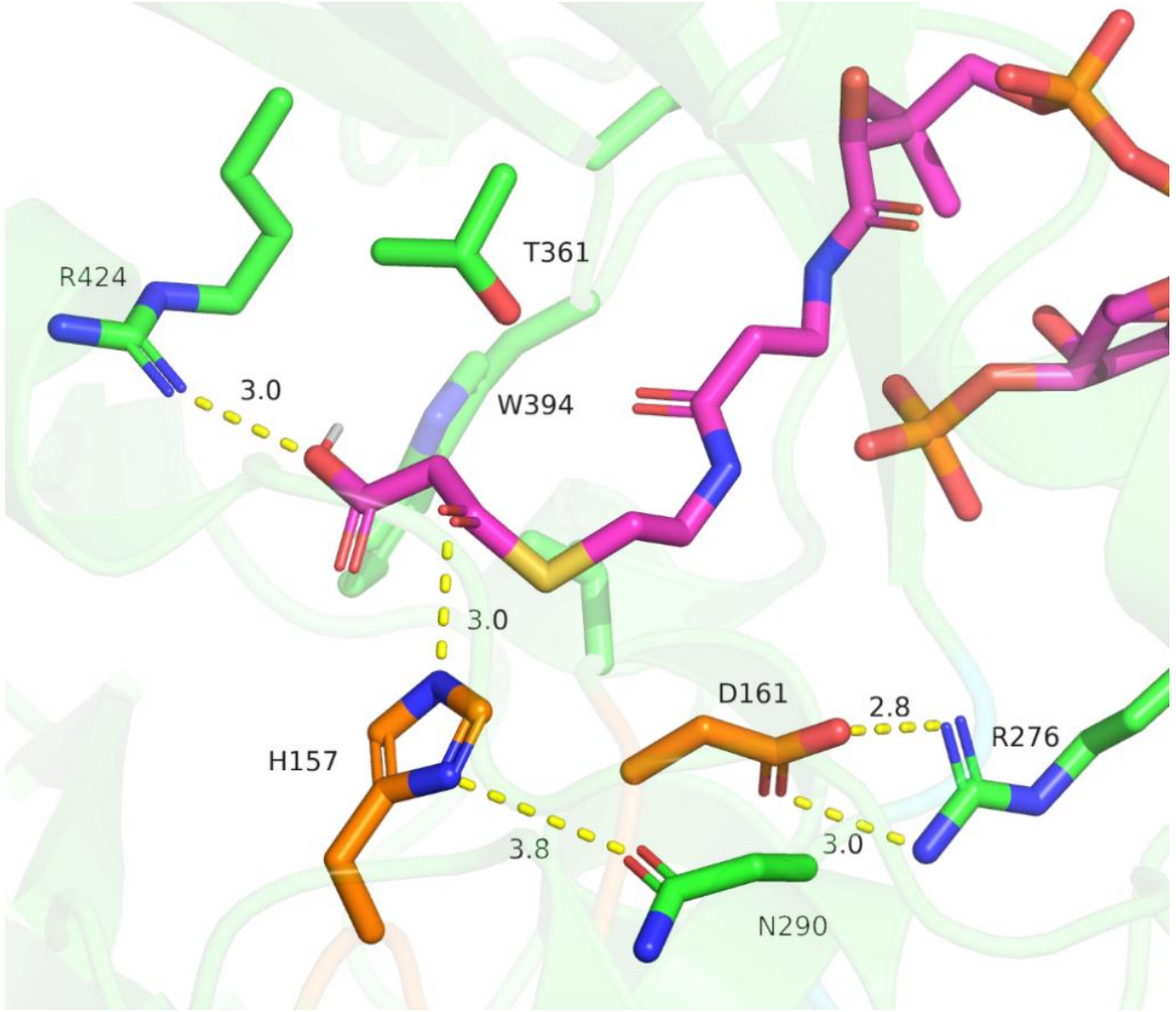
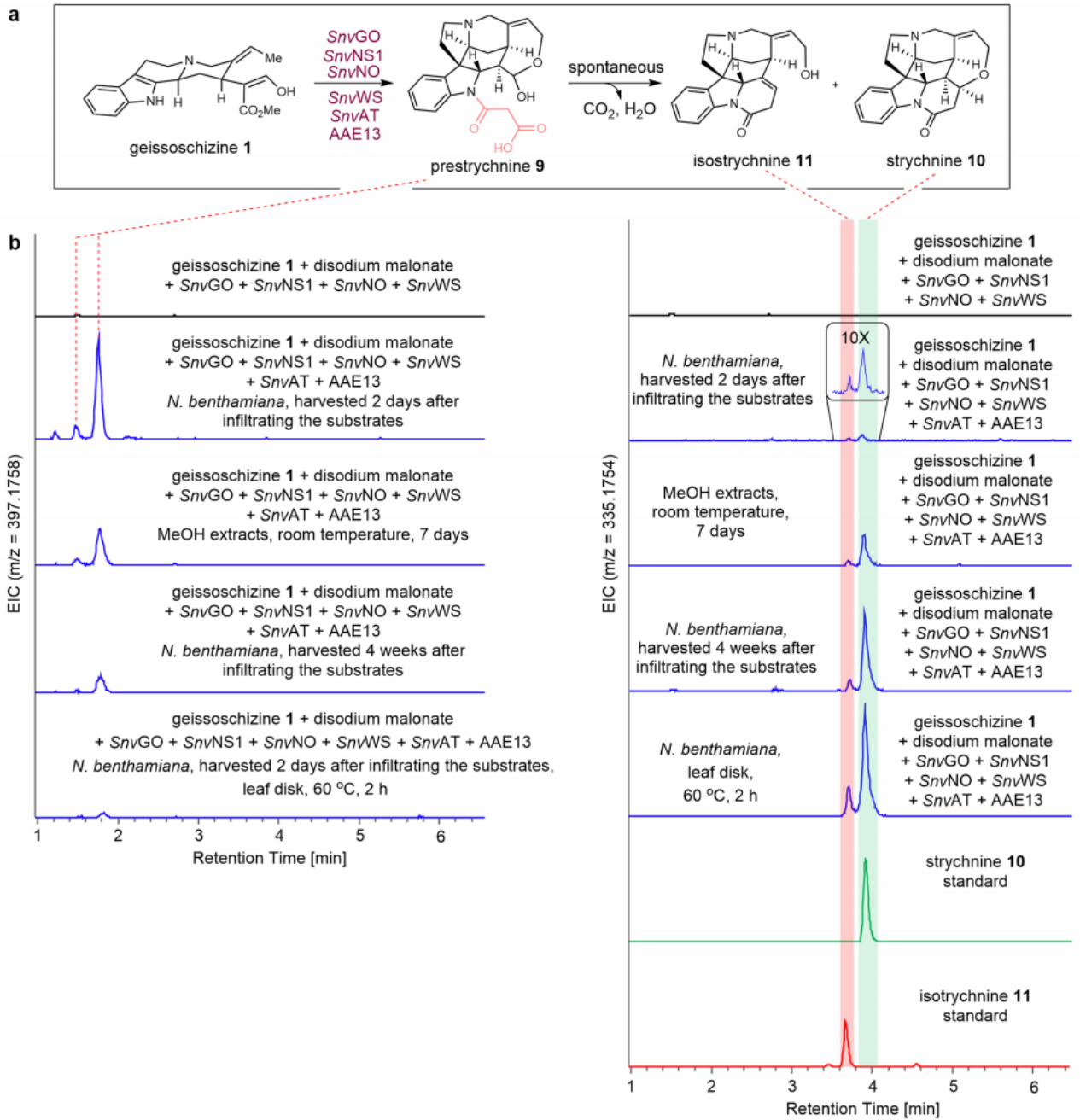
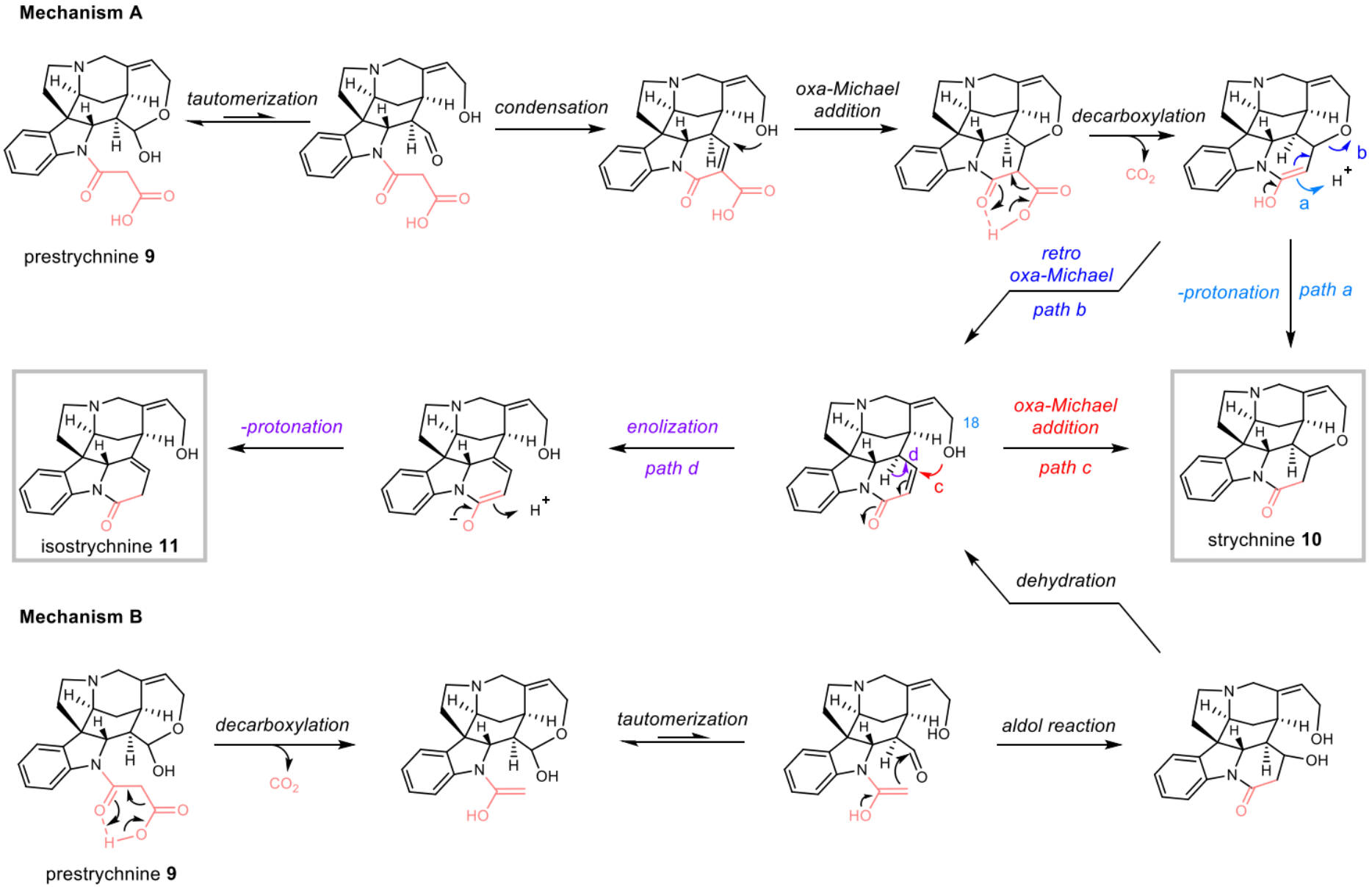


Docking model of *Snv*AT with malonyl-CoA

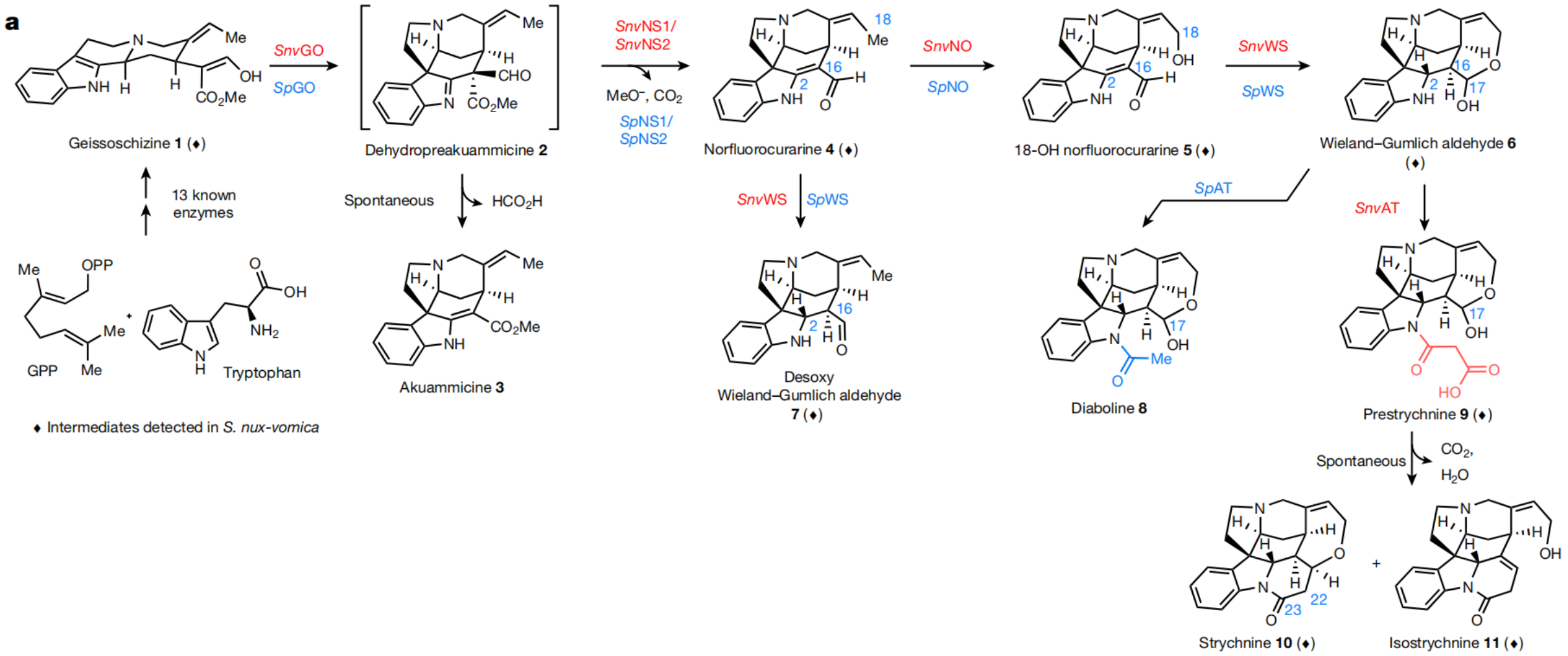
From Weiland-Gumlich aldehyde 6 to strychnine 10



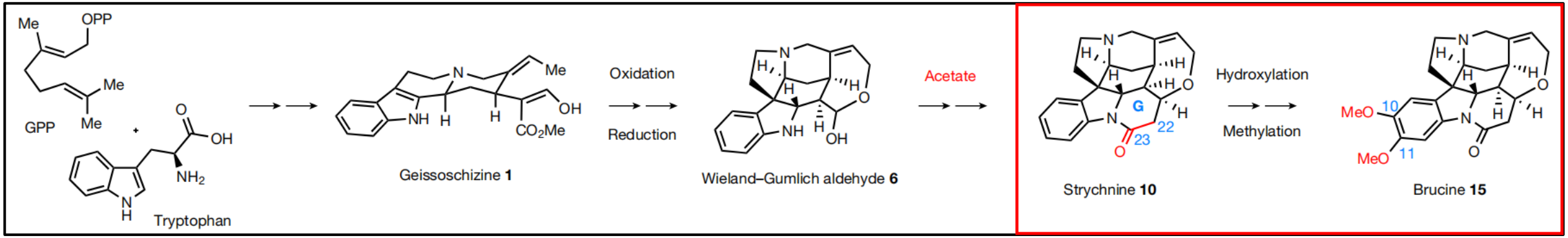
Proposed mechanism for the strychnine 10 and isostrychnine 11 formation



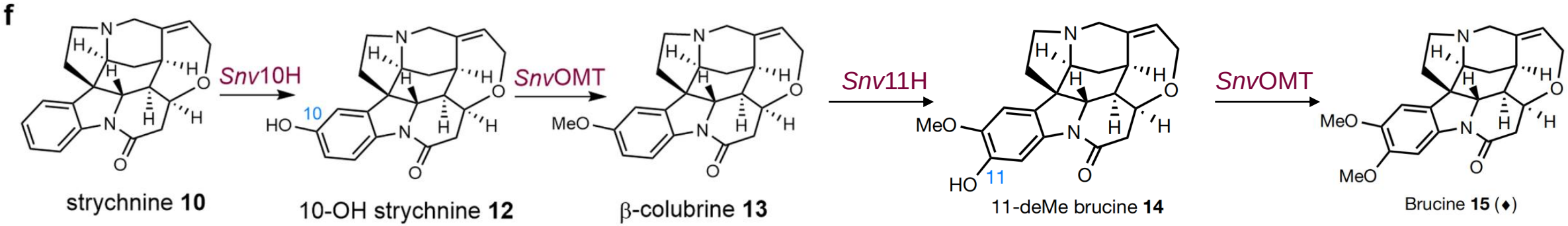
From Weiland-Gumlich aldehyde 6 to strychnine 10



The proposed biosynthesis pathway for strychnine and brucine

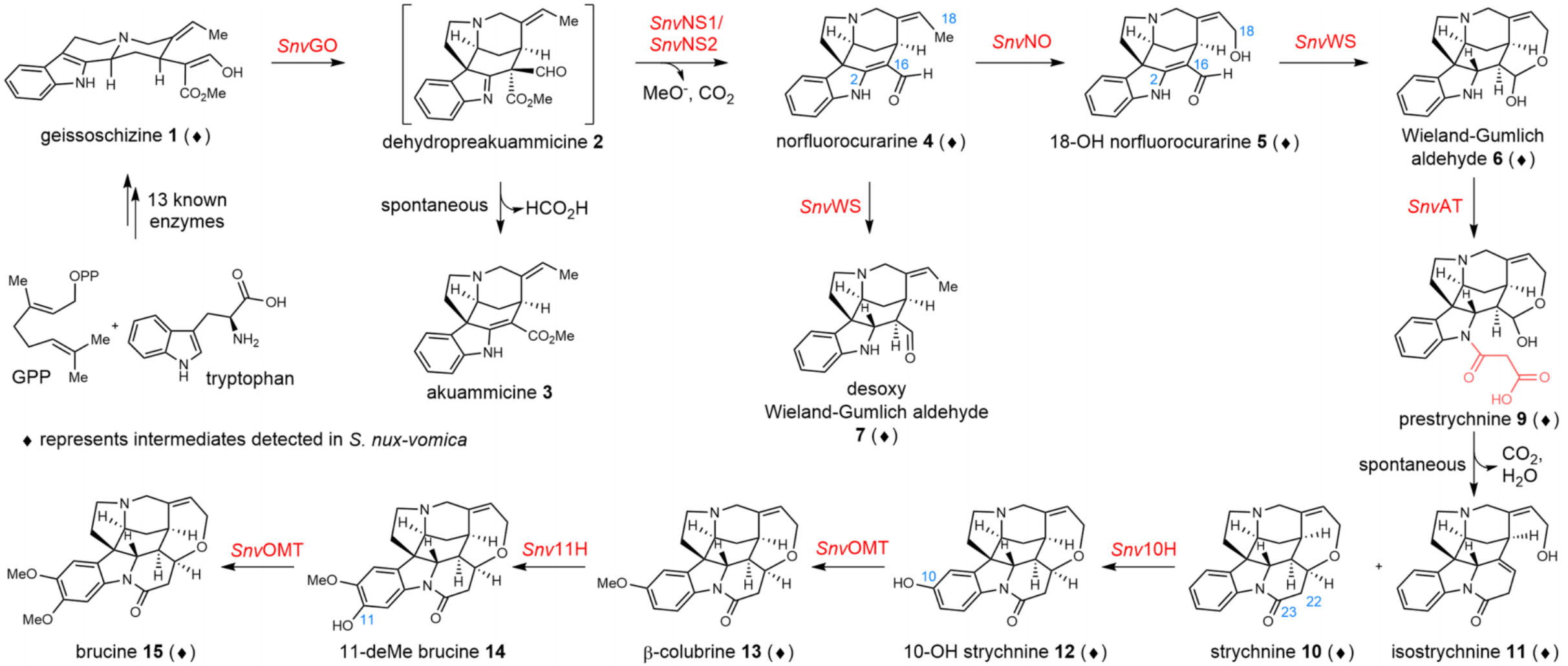


From strychnine 10 to brucine 15

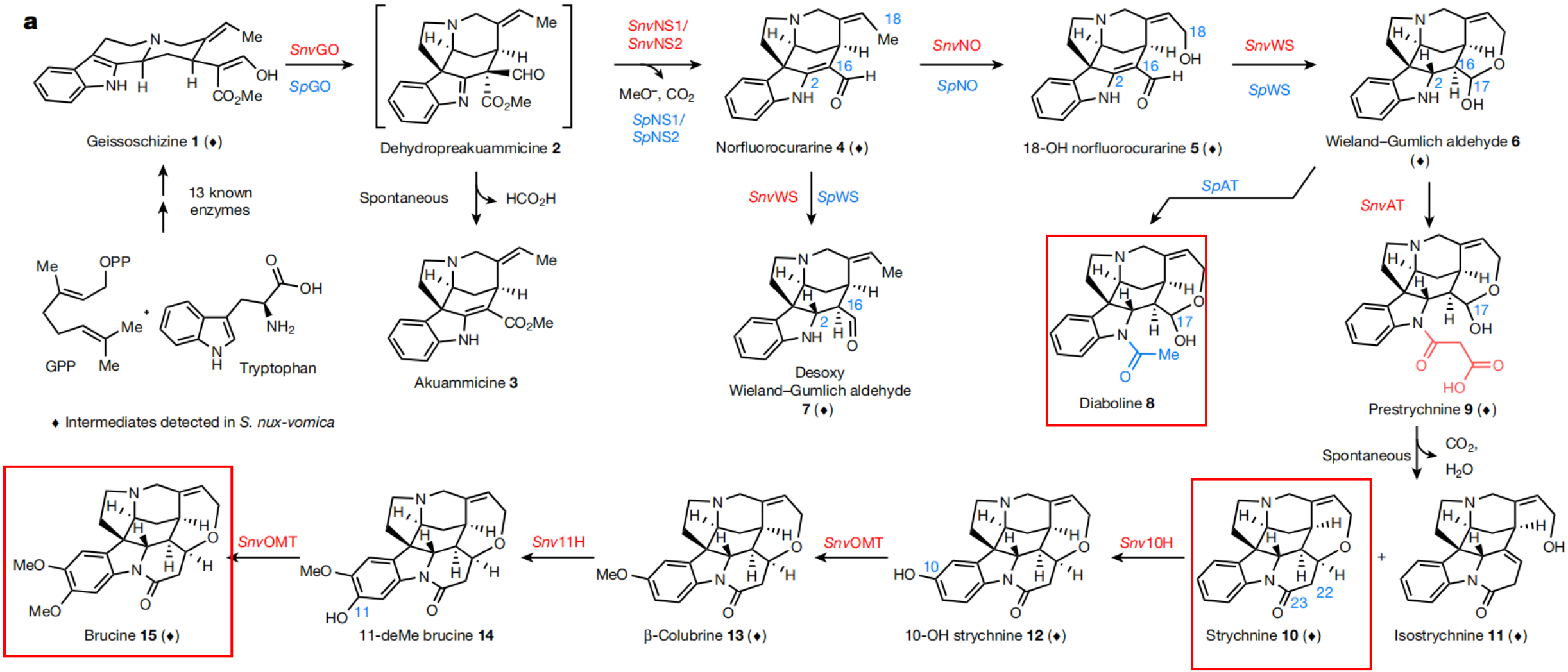


- 12 full-length cytochrome P450 proteins → *Snv*10H
- 5 methyltransferases → *Snv*OMT
- 3 cytochrome P450 proteins → *Snv*11H

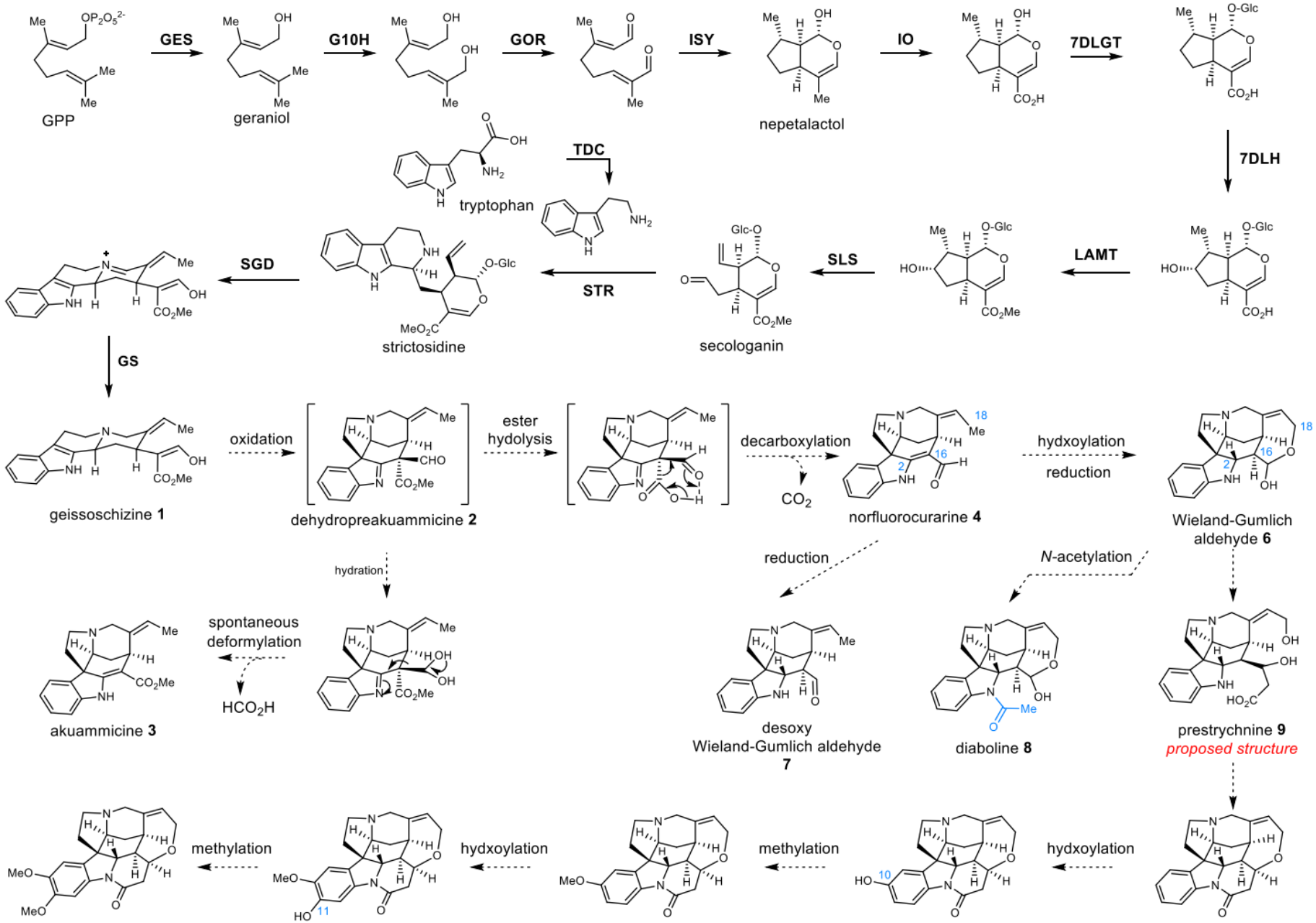
From geissoschizine 1 to strychnine 10 and brucine 15



The complete biosynthetic pathway leading to the production of diaboline **8**, strychnine **10** and brucine **15**



Proposed biosynthetic pathway for diboline 8, strychnine 10, and brucine 15



Thank you!