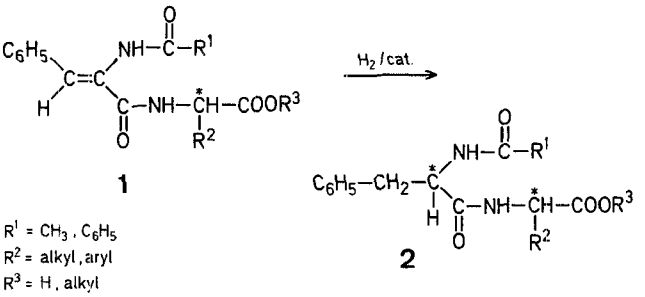
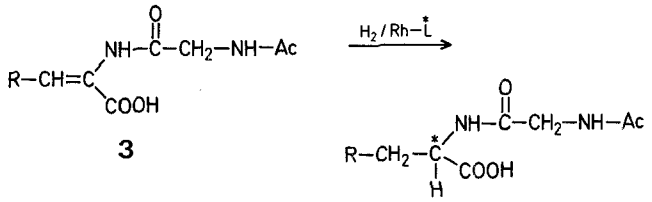


1 2

R^1 = CH_3, C_6H_5
R^2 = alkyl, aryl
R^3 = H, alkyl

This hydrogenation requires the presence of an asymmetric C-atom in the dehydropeptide **1**. In other words, the substrate **1** must be an optically active compound.

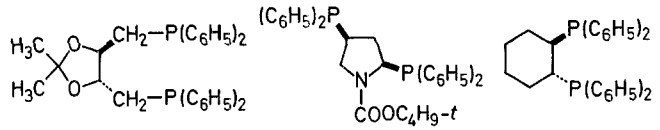
We report here our results obtained in the asymmetric hydrogenation of dehydrodipeptides of the type **3** [2-(acetylamino-acetylamino)-2-alkenoic acids] to the dipeptides **4** using chiral rhodium catalysts.



3 **4**

L* = 5,6,7

The catalysts used were complexes of rhodium(I) modified with three different chiral phosphine ligands (**5**[9], **6**[10], **7**[11]).



(+)-DIOP (**5**) (–)-BPPM (**6**) (*R,R*)-2 (**7**)

Dipeptides (4) by Asymmetric Hydrogenation of 2-(Acetylaminoacetyl-amino)-2-alkenoic Acids (3); General Procedure:

The *N*-substituted 2-amino-2-alkenoic acid (**3**; 20 mol) is dissolved in deoxygenated ethanol (50 ml). A solution of the catalyst prepared *in situ* from norbornadienerhodium chloride and **5**, **6**, or **7** (for amount, see Table) in ethanol (25 ml) is added and the mixture is placed in an autoclave. Hydrogenation is carried out at room temperature at a pressure of 10–25 bar (see Table). After uptake of the theoretical amount of hydrogen, the hydrogenation is stopped, the mixture treated with an

Asymmetric Synthesis of Peptides

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The asymmetric catalytic hydrogenation of α-acylamino-acrylic acids with chiral rhodium-phosphine-complexes has opened a new pathway to optically active amino-acids[1–6] and has been successfully applied to the synthesis of dipeptides of the type **2**[7,8].

Table. Dipeptides **4** obtained by Asymmetric Hydrogenation of Dehydropeptides **3**[a]

R	L*	H_2 pressure [bar]	Ratio **3** : catalyst [mol/mol]	$[\alpha]_D^{25}$	Optical yield [%]	Configuration
i-C_3H_7	**5**	10	320	– 6.7° (*c* 1, H_2O)[b]	27	(*S*)
i-C_3H_7	**6**	12.5	400	+ 14.7° (*c* 1, H_2O)[b]	58	(*R*)
i-C_3H_7	**7**	11	350	+ 9.5° (*c* 1, H_2O)[b]	37.5	(*R*)
C_6H_5	**5**	20	400	+ 19.5° (*c* 2, ethanol)[c]	44	(*S*)
C_6H_5	**6**	15	350	– 27.7° (*c* 2, ethanol)[c]	63	(*R*)
C_6H_5	**7**	25	350	– 17.3° (*c* 2, ethanol)[c]	39.3	(*R*)

[a] All hydrogenations were carried out in ethanol at room temperature; reaction time: 5–24 h; yield: almost quantitative in all cases examined. The microanalyses of all dipeptides **4** were in satisfactory agreement with the calculated values: C, ±0.20; H, ±0.20; N, ±0.10.
[b] Optical rotation of the pure peptide[12]: *N*-Acetylglycyl-(*S*)-leucine, $[\alpha]_D^{29}$: – 25.3° (*c* 1, H_2O).
[c] Optical rotation of the pure peptide[13]: *N*-Acetylglycyl-(*S*)-phenylalanine, $[\alpha]_D^{20}$: + 44° (*c* 2, ethanol).

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acidic ion-exchange resin (2 g) to remove the catalyst, and filtered. The filtrate is evaporated to dryness under reduced pressure. The yield is almost quantitative in all cases.

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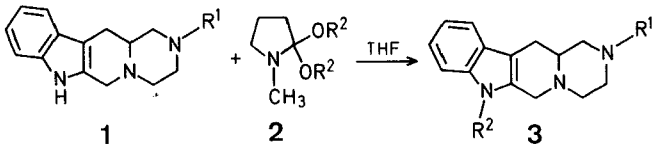
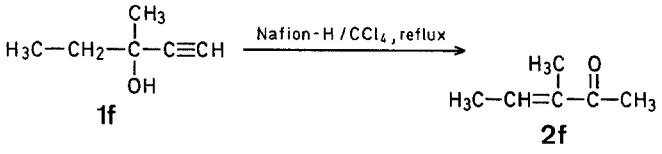
[1] D. Valentine, J. W. Scott, *Synthesis* **1978**, 329.
[2] L. Horner, *Kontakte* **1979** (3), 3; **1980** (1), 37.
[3] H. B. Kagan, J. C. Fiand, *Top. Stereochem.* **10**, 175 (1978).
[4] H. Brunner, *Naturwiss. Rundsch.* **1979**, 393.
[5] H. Brunner, W. Pieronczyk, *Angew. Chem.* **91**, 655 (1979); *Angew. Chem. Int. Ed. Engl.* **18**, 620 (1979).
[6] W. Bergstein, A. Kleemann, J. Martens, *Synthesis* **1981**, 76.
[7] I. Ojima, T. Suzuki, *Tetrahedron Lett.* **1980**, 1239.
[8] K. Onuma, T. Ito, A. Nakamura, *Chem. Lett.* **1980**, 481.
[9] H. B. Kagan, T. P. Dang, *J. Am. Chem. Soc.* **94**, 6429 (1972).
[10] K. Achiwa, *J. Am. Chem. Soc.* **98**, 8265 (1976).
[11] K. Onuma, T. Ito, A. Nakamura, *Chem. Lett.* **1979**, 905.
[12] W. Cahill, I. Burton, *J. Biol. Chem.* **132**, 167 (1940).
[13] I. Antonovics, G. T. Young, *J. Chem. Soc. [C]* **1967**, 595.

0039-7881/81/0932-0741 $ 03.00

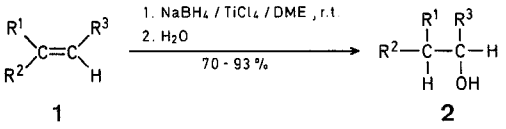
S. K. Agarwal, A. K. Saxena, N. Anand, *Synthesis* **1981** (6), 465-466:
The formula scheme (p. 465) should be:



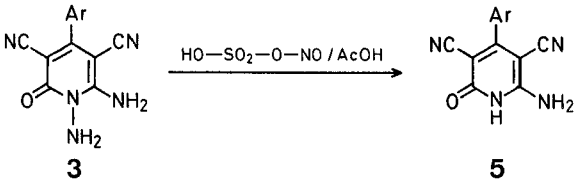
G. A. Olah, A. P. Fung, *Synthesis* **1981** (6), 473-474:
The reaction scheme **1f→2f** should be:



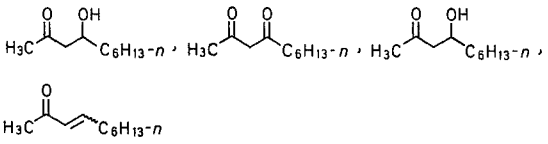
Abstract 6127, *Synthesis* **1981** (6), 498:
The formula scheme **1→2** should be:



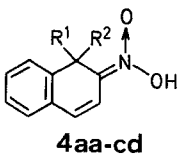
J. L. Soto, C. Seoane, P. Zamorano, F. J. Cuadrado, *Synthesis* **1981** (7), 529-530:
The reaction scheme **3→5** (p. 529) should be:



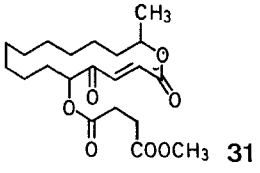
A. B. Smith, III, P. A. Levenberg, *Synthesis* **1981** (7), 567-570:
The heading for Table 1 (p. 567) should be Oxidation of 4-Hydroxy-2-decanone **(3a)** under various conditions. The structure given in the first column of Table 1 should be, respectively:



G. Bartoli, M. Bosco, A. C. Boicelli, *Synthesis* **1981** (7), 570-572:
The structure of products **4aa-cd** (p. 571) should be:

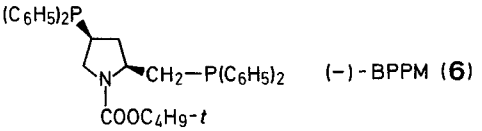


Y.-H. Lai, *Synthesis* **1981** (8), 585-604:
The structure of compound **31** (p. 588) should be:

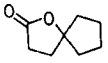


M. R. H. Elmoghayar, M. K. A. Ibraheim, A. H. H. Elghandour, M. H. Elnagdi, *Synthesis* **1981** (8), 635-637:
The title compounds **5** are thiazolo[3,2-*a*]pyridine derivatives.

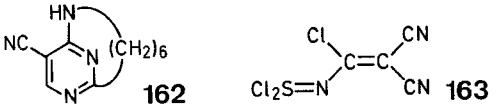
A. Kleemann, J. Martens, M. Samson, W. Bergstein, *Synthesis* **1981** (9), 740-741:
The structure of compound **6** should be:



Abstract 6236, *Synthesis* **1981** (11), 922:
The structure of product **3** should be:

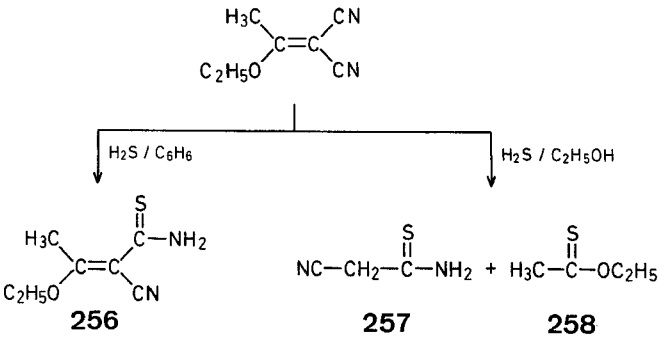


F. Freeman, *Synthesis* **1981** (12), 925-954:
The structures of compounds **162** and **163** (p. 937) should be:

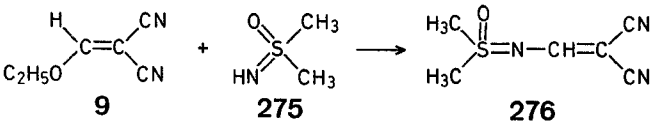


The text of the first paragraph starting on p. 943 (right-hand column) should be: Hydrogen sulfide reacts with 1-ethoxyethylidenemalononitrile, the methyl homolog of **9**, to give different products depending on the solvent used[293].

The following formula scheme should be:



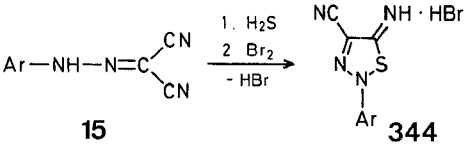
The first formula scheme on p. 944 (right-hand column) should be:



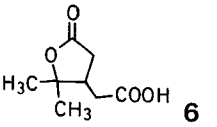
The last sentence on page 946 (left-hand column) should be: An analogous reaction with cyclopentadiene leads to the 2-azabicyclo[2.2.1]heptene **(299)** and with cyclohexadiene to 2-azabicyclo[2.2.2]octene **(301)** derivatives[317].

The correct names for compounds **336** and **337** (p. 949) are 5-hydroxy-2-oxo-3-phenylazo-1,2,3,7-tetrahydropyrazolo[1,5-*a*]pyrimidine **(336)** and α-(*N*-methylphenylhydrazono)-cyanoacetamidrazone **(337)**.

The formula scheme **15→344** (p. 950) should be:



A. Guzmán, S. Mendoza, E. Diaz, *Synthesis* **1981** (12), 989-991:
The structure of compound **6** (p. 990) should be:



Abstract 6269, *Synthesis* **1981** (12), 1015:
The legend under the formula scheme should read: n = 1, 2, 3.