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Scheme S1. Synthetic scheme for the preparation of hydrochloride dipeptide esters P1-P5 (AA₁= Sar, L/D-Pro; AA₂=L/D-Ala, Aib; R= O*t*Bu, OTEG). (1) and (2) Z-OSu, triethylamine, CH₃CN/H₂O; (3) –OtBu: isobutene, H₂SO₄ cat., CH₂Cl₂; -OTEG: EDC/DMAP/HOBt* (Figure S1), triethylen glycol monomethyl ether, CH₂Cl₂; (4) H₂, Pd/C (10% w/w), methanol; (5) for the Sar-derivatives isobutyl chloroformiate (Figure S2), *N*-methylmorpholine, tetrahydrofurane; for the Pro-derivatives EDC, HOBt, diethylisopropylamine, dichloromethane; (6a) H₂, Pd/C, methanol; (6b) HCl/diethylether.

*1-ethyl-3-(3-dimethylaminopropyl)carbodiimide/4-dimethylaminopyridine/Hydroxybenzotriazole

Compound -	Weight	loss (%)	DSC
	Found	Calculated	Peak temperature [°C] (process*)
IT01	67.95	69.61	158.0 (endo); 499.4 (exo)
IT02	67.90	69.61	151.0 (endo); 469.4 (exo)
IT03	72.00	71.38	113.7 (endo); 439.7 (exo)
IT04	71.89	71.38	178.0 (endo); 436.7 (exo)
IT05	73.82	72.61	122.6 (endo); 493.7 (exo); 542.1 (exo)

Table S1. Thermogravimetric (TG) and differential scanning calorimetric (DSC) data.

*endo/exo=endothermic/exothermic

					Vibratic	onal mode	[cm ⁻¹]			
	ν NH	Va/s	ν	amide I	ν N -	Amide	Amide	Va/s	Va/s	Va/s
		NH_{2}^{+}	C=O		CSS	II	III	SCS	SAuS	BrAuBr
P1	3332	2763	1735	1669	-	1564	1266	-	-	-
IT01	3317	-	1733	1668	1564	1 a	1219	1003/	419/	251/
								567	380	229
P2	3332	2766	1735	1669	-	1564	1266	-	-	-
IT02	3311	-	1732	1668	1563	3 ^a	1218	1003/	419/	251/
								566	380	228
P3	3430	2744	1733	1678	-	1551	1256	-	-	-
IT03	3341	-	1730	1680	1553	3 ^a	1247	1000/	410/376	252/222
								535		
P4	3437	2744	1733	1678	-	1551	1256	-	-	-
IT04	3363		1732	1680	154	Qa	1241	991/	410/	251/
1104	0000		17.52	1000	104	0	1271	533	376	201/
P5	3193	2762	1739	1684	_	1554	1256	-	-	-
IT05	3200	-	1735	1683	1576	15/0	1253	1022/	112/300	250/ 226
1100	0200		1700	1000	10/0	1010	1200	569	712/000	200/ 220

Table S2. Selected IR frequencies of the starting dipeptides P1-P5 and the corresponding gold(III) dithiocarbamato derivatives IT01-IT05.

^a $v_{\text{N-CSS}}$ and amide II are overlapped.

The main signals generated by the peptide chains are the vibration mode of the amide-proton bond (v_{N-H}) at 3550-3200 cm⁻¹ (Amide A band), and the three bands characteristic of the C(O)NH function, resulting from the combination of the v(C=O), $\delta(N-H)$ and v(C-N) vibration modes (referred to as amide I, II and III).

With respect to the formation of the gold(III) dithiocarbamato complexes, there are three main diagnostic regions:

- the 1580-1450 cm⁻¹ region, primarily associated with the v(N-CSS) vibration mode ("thioureide" band);

- the 1060-940 cm⁻¹ region, associated with the v(S-C-S) vibration modes;

- the 420-350 cm⁻¹ region, associated with the v(M-S) vibration modes.

Upon complex formation, the deprotonation step of the HCl dipeptide to form the corresponding dithiocarbamato ligand causes the disappearance of the signal at 2766-2736 cm⁻¹ of the $v_{a/s}(NH_2^+)$ vibration mode, and the appearance of both the v(N-CSS) band at 1580-1450 cm⁻¹ (somewhat overlapped to amide II band) and the $v_a(S-C-S)$ band at 1060-940 cm⁻¹.

As described by Chatt *et al.*,^[39] the dithiocarbamato moiety is characterized by a strong delocalization of the electrons, being described by three main resonance structures (Figure S3). The position of the v(N-CSS) bands recorded for our compounds is consistent with the presence of a carbon-nitrogen bond order which lies between a single bond (v=1350-1250 cm⁻¹) and a double bond (\tilde{v} =1690-1640 cm⁻¹).^[40] This is in agreement with a relevant contribution to the final structure

of the resonance form III reported in Figure S3, characterized by a symmetric chelated coordination of the dithiocarbamato function to the gold(III) metal center.^[52] Likewise, the presence of a single band for the v_a (S-C-S) at 1022-991 and the v_s (S-C-S) at 569-533 cm⁻¹ validates a bidentate symmetric coordination of the ligand to the metal center (Figure S4).^[53] In the Far FT-IR region, the formation of a symmetrically-chelated dithiocarbamato is further confirmed by the position of the metal-sulfur stretching vibrations $v_{a/s}$ (S-Au-S) at 419-410/390-376 cm⁻¹, in agreement with previously reported data.^[52, 54] The bands related to the *cis*-coordinated halides $v_{a/s}$ (Br-Au-Br) set at 252-250/229-220 cm⁻¹.^[52, 54-55]

Compound		δ (¹³ C) [p		
	-OR	AA ₁	AA ₂	C-SS
P1	R=fBu 27.36(-C(C H ₃) ₃) 80.58(- C (CH ₃) ₃)	AA ₁ =Sar 32.40(N- CH ₃) 48.53(N- CH ₂) 164.86 (C=O)	AA₂=L-Ala 16.75 (β- C H₃) 48.29 (α- C H) 171.27 (C =O)	-
IT01*	28.35(-C(C H ₃) ₃) 82.36(- C (CH ₃) ₃)	40.5 (N- C H ₃) 55.5 (N- C H ₂) 164.72 (C =O)	18.34 (β- C H ₃) 50.35 (α- C H) 172.54 (C =O)	198.2
P2	R= <i>t</i> Bu 27.28(-C(CH ₃) ₃) 80.55(-C(CH ₃) ₃)	AA ₁ =Sar 32.41(N- CH ₃) 48.52(N- CH ₂) 164.87 (C=O)	AA₂=D-Ala 16.76(β- CH ₃) 48.29(α- C H) 171.22 (C =O)	-
IT02*	27.69(-C(CH ₃) ₃) 81.70(-C(CH ₃) ₃)	39.9 (N- CH ₃) 54.83 (N- CH ₂) 163.81 (C=O)	17.67 (β- C H ₃) 49.68 (α- C H) 171.88 (C =O)	197.72
P3	R= <i>t</i>Bu 27.13(-C(C H ₃) ₃)	AA₁=L-Pro 23.28 (C H ₂ ⁴)	AA₂=Aib 55.69 C(CH ₃)₂ 24.41 (CH ₃)	-
	79.65(- C (CH ₃) ₃)	29.59 (C H ₂ ³) 45.32 (C H ₂ ⁵) 58.07 (C H ²) 167.15 (C =O)	172.15 (C =O)	
IT03*	28.00(-C(C H ₃) ₃)	23.09 (C H ₂ ⁴)	25.01 (C H ₃) 57.28 C (CH ₃) ₂ 172.84 (C =O)	190.22
	80.98(- C (CH ₃) ₃)	30.84 (CH ₂ ³) 52.10 (CH ₂ ⁵) 64.87 (CH ²) 166.69 (C=O)		
P4	R= <i>t</i>Bu 27.19(-C(C H₃)₃)	AA₁=D-Pro 23.56 (C H ₂ ⁴)	AA ₂ =Aib 24.50 (CH ₃) 55.70 C(CH ₃) ₂ 172.06 (C=O)	-
	79.65(- C (CH ₃) ₃)	29.67 (C H ₂ ³) 45.55 (C H ₂ ⁵) 58.26 (C H ²) 167.75 (C =O)		
IT04*	27.97(-C(C H ₃) ₃)	23.16 (C H ₂ ⁴)	24.95 (C H ₃) 57.44 C (CH ₃) ₂	190.21
	81.10(- C (CH ₃) ₃)	30.80 (CH ₂ ³) 52.08 (CH ₂ ⁵) 64.92 (CH ²)	172.96 (C =O)	

Table S3. ¹³C NMR spectral data of the starting dipeptides P1-P5 (HCI·H-AA₁-AA₂-OR: AA₁= Sar, L/D-Pro; AA₂=D/L-Ala, Aib; R= -*t*Bu, TEG) and the corresponding gold(III)-dithiocarbamato derivatives IT01-IT05 ([Au^{III}Br₂(dtc-AA₁-AA₂-OR]) (DMSO-d₆, 298 K, 75.48 MHz).

166.94 (**C**=O)

P5	R=TEG 57.26 (O- C H ₃) 63.19 (C H ₂ ¹)	AA₁=Sar 31.84 (N- C H ₃)	AA₂=Aib 23.39(β-CH ₃) 54.77 C (CH ₃) ₂ 172.52 (C =O)	
	67.44 (C H ₂ ²)	47.94 (N- C H ₂)		
	68.8-70.7 (C H ₂ ^{3,4,5,6})	163.80 (C =O)	172.52 (C =O)	
IT05*	58.52 (O C H ₃)	39.86 (N C H ₃)	24.86(β- C H ₃) 57.00 C (CH ₃) ₂	197.3
	64.52 (C H ₂ ¹) 69.25 (C H ₂ ²)	54.84 (N C H ₂) 163.54 (C =O)	173.63 (C =O)	

70.8-71.2 (**C**H₂^{3,4,5,6})

* acetone-d₆ (recorded in such a solvent due to signal overlapping with DMSO resonances).

Empirical formula	$C_{20}H_{39}AuBr_2N_2O_6S_2$
Formula weight	824.44
Colour, habit	Yellow, block
Crystal size, mm	0.07x0.04x0.04
Crystal system	Orthorhombic
Space group	<i>P</i> bcn
<i>a</i> , Å	22.15(2)
<i>b</i> , Å	9.599(9)
<i>c</i> , Å	25.88(2)
α , deg.	90
β, deg .	90
γ, deg.	90
<i>V</i> , Å ³	5503(8)
Ζ	8
<i>Т</i> , К	293(2)
ho (calc), Mg/m³	1.990
μ , mm ⁻¹	8.440
heta range, deg.	1.82 to 20.75
No.ofrflcn/unique	9221 / 2636
GooF	1.028
<i>R</i> 1	0.0877
wR2	0.1774

Table S4. Summary of X-ray crystallographic data for IT05·pentane.

 $R1 = \Sigma ||F_0| - |F_c|| / \Sigma |F_0|, \ wR2 = [\Sigma[w(F_0^2 - F_c^2)^2] / \Sigma[w(F_0^2)^2]]^{\frac{1}{2}}, \ w = 1/[\sigma^2(F_0^2) + (aP)^2 + bP], \ \text{where} \ P = [\max(F_0^2, 0) + 2F_c^2] / 3$

Au-Br(1)	2.429(4)	C(1)-N(1)	1.32(3)
Au-Br(2)	2.431(5)	C(4)-O(1)	1.27(3)
Au-S(1)	2.310(9)	C(4)-N(2)	1.33(3)
Au-S(2)	2.306(9)	C(8)-O(2)	1.21(4)
C(1)-S(1)	1.78(3)	C(8)-O(3)	1.36(4)
C(1)-S(2)	1.71(3)		
Br(1)-Au-Br(2)	94.0(2)	S(1)-C(1)-S(2)	108(2)
S(1)-Au-S(2)	75.7(3)	C(1)-S(1)-Au	87(1)
Br(1)-Au-S(1)	96.1(2)	C(1)-S(2)-Au	89(1)
Br(2)-Au-S(2)	94.1(2)		

Table S5. Selected bond lengths (Å) and angles (°) for IT05 pentane.

Table S6. Crystallographic data and structure refinement for the racemate IT03/IT04 [Au^{III}Br₂(dtc-L,D-Pro-Aib-O*t*Bu)] acetone solvate.

Identification code	mc181fl
Empirical formula	$C_{14}H_{23}AuBr_2N_2O_3S_2 \ x \ C_3H_6O$
Formula weight	746.33
Temperature	293(2) K
Wavelength	0.71070 Å
Crystal system	Orthorhombic
Space group	Pbca
Unit cell dimensions	$a = 16.5424(6) \text{ Å}$ $\alpha = 90^{\circ}.$
	$b = 11.7649(4) \text{ Å} \qquad \beta = 90^{\circ}.$
	$c = 26.3963(7) \text{ Å}$ $\gamma = 90^{\circ}.$
Volume	5137.2(3) Å ³
Z	8
Density (calculated)	1.930 Mg/m ³
Absorption coefficient	9.024 mm ⁻¹
F(000)	2864
Crystal size	0.50 x 0.40 x 0.15 mm ³
Theta range for data collection	3.09 to 26.37°.
Index ranges	-20<=h<=20, -14<=k<=14, -25<=l<=27
Reflections collected	9339
Independent reflections	3000 [R(int) = 0.0488]
Completeness to theta = 26.37°	57.1 %
Absorption correction	Semi-empirical from equivalents
Max. and min. transmission	1.00000 and 0.20457
Refinement method	Full-matrix least-squares on F ²
Data / restraints / parameters	3000 / 158 / 285
Goodness-of-fit on F ²	1.255
Final R indices [I>2sigma(I)] $R_1 = 0.0871, wR_2 = 0.1526$	
R indices (all data)	$R_1 = 0.1151, wR_2 = 0.1610$
Largest diff. peak and hole	0.783 and -1.024 e.Å ⁻³

Au-Br(1)	2.420(3)	C(1)-N(1)	1.28(2)
Au-Br(2)	2.435(3)	C(6)-O(1)	1.23(2)
Au-S(1)	2.313(6)	C(6)-N(2)	1.32(2)
Au-S(2)	2.307(7)	C(10)-O(2)	1.25(3)
C(1)-S(1)	1.71(2)	C(10)-O(3)	1.29(3)
C(1)-S(2)	1.74(2)		
Br(1)-Au-Br(2)	93.64(12)	S(1)-C(1)-S(2)	110.3(12)
S(1)-Au-S(2)	75.7(2)	C(1)-S(1)-Au	87.1(8)
Br(1)-Au-S(1)	95.77(18)	C(1)-S(2)-Au	86.8(8)
Br(2)-Au-S(2)	94.93(18)		

Table S7. Selected bond lengths (Å) and angles (°) for the racemate IT04 [Au^{III}Br₂(dtc-L,D-Pro-Aib-O*t*Bu)].

|--|

Identification code	Z-L-Pro-Aib-O <i>t</i> Bu	
Empirical formula	C21 H30 N2 O5	
Formula weight	390.47	
Temperature	293(2) K	
Wavelength	1.54178 Å	
Crystal system	Orthorhombic	
Space group	P 21 21 21	
Unit cell dimensions	a = 10.050(2) Å	α= 90°.
	b = 10.460(2) Å	β= 90°.
	c = 21.305(3) Å	γ = 90°.
Volume	2239.6(7) Å ³	
Z	4	
Density (calculated)	1.158 Mg/m ³	
Absorption coefficient	0.674 mm ⁻¹	
F(000)	840	
Crystal size	0.50 x 0.35 x 0.20 mm ³	
Theta range for data	4.15 to 59.97°.	
collection		
Index ranges	-1<=h<=11, 0<=k<=11,	
	0<=l<=23	
Reflections collected	2158	
Independent reflections	2121 [R(int) = 0.1078]	
Completeness to theta =	99.9 %	
59.97°		
Max. and min.	0.8770 and 0.7293	
transmission		
Refinement method	Full-matrix-block least-	
	squares on F ²	
Data / restraints /	2121 / 4 / 250	
parameters		
Goodness-of-fit on F ²	0.992	
Final R indices	R1 = 0.0611, wR2 =	
[l>2sigma(l)]	0.1612	
R indices (all data)	R1 = 0.0774, wR2 =	
	0.1735	
Absolute structure	-0.1(5)	

parameter	
Largest diff. peak and	0.258 and -0.174 e.Å ⁻³
hole	

Table S9. Bond lengths [Å] and angles [°] for Z-L-Pro-Aib-OtBu.

	1.39
C01-C02	1.39
C01-C07	1,491(5)
C02-C03	1.39
C03-C04	1.39
C04-C05	1.39
C05-C06	1.39
C07-OU	1.421(5)
OU-C0	1.335(5)
C0-O0	1.231(5)
C0-N1	1.325(5)
N1-C1D	1.456(6)
N1-C1A	1.464(5)
C1A-C1	1.523(6)
C1A-C1B	1.528(6)
C1B-C1G	1.480(8)
C1B-C1G'	1.487(8)
C1G-C1D	1.499(8)
C1G'-C1D	1.497(8)
C1-O1	1.230(5)
C1-N2	1.345(5)
N2-C2A	1.444(6)
C2A-C2B2	1.519(6)
C2A-C2B1	1.536(6)
C2A-C2	1.536(6)
C2-O2	1.204(5)
C2-OT	1.335(5)
OT-CT1	1.481(5)
CT1-CT2	1.501(8)
CT1-CT4	1.501(8)
CT1-CT3	1.507(8)
C02-C01-C06	120
C02-C01-C07	122.4(3)
C06-C01-C07	117.6(3)
C01-C02-C03	120
C02-C03-C04	120
C05-C04-C03	120
C04-C05-C06	120
C05-C06-C01	120
OU-C07-C01	109.0(3)
C0-OU-C07	116.0(3)

00-C0-N1	124 8(4)		
00-C0-QU	124.0(4)		
N1-C0-QU	111 8(3)		
C0-N1-C1D	122.1(4)		
C0-N1-C1A	122.6(4)		
C1D-N1-C1A	112.3(3)		
N1-C1A-C1	110.3(3)		
N1-C1A-C1B	102.9(3)		
C1-C1A-C1B	112.2(4)		
C1G-C1B-C1A	106.7(5)		
C1G-C1B-C1G'	28.6(7)		
C1A-C1B-C1G'	103.9(5)		
C1B-C1G-C1D	107.9(6)		
C1D-C1G'-C1B	107.6(6)		
N1-C1D-C1G'	103.9(5)		
N1-C1D-C1G	100.9(5)		
01-C1-N2	122.6(4)		
O1-C1-C1A	122.6(4)		
N2-C1-C1A	114.9(3)		
C1-N2-C2A	123.3(3)		
N2-C2A-C2B2	111.3(4)		
N2-C2A-C2B1	108.1(4)		
C2B2-C2A-C2B1	109.4(4)		
N2-C2A-C2	112.0(3)		
C2B2-C2A-C2	109.9(4)		
C2B1-C2A-C2	106.0(3)		
02-C2-OT	124.9(4)		
O2-C2-C2A	123.1(4)		
OT-C2-C2A	111.8(3)		
C2-OT-CT1	120.8(3)		
OT-CT1-CT2	109.8(4)		
OT-CT1-CT4	108.3(5)		
CT2-CT1-CT4	115.2(6)		
OT-CT1-CT3	102.1(4)		
CT2-CT1-CT3	110.7(6)		
CT4-CT1-CT3	109.9(5)		

C02-C01-C07-OU	32.7(6)
C06-C01-C07-OU	-147.7(4)
C01-C07-OU-C0	170.2(4)
C07-OU-C0-N1	176.2(5)
OU-C0-N1-C1A	-17.5(6)
C0-N1-C1A-C1	-60.0(5)
N1-C1A-C1-N2	168.8(3)
C1A-C1-N2-C2A	175.7(3)
C1-N2-C2A-C2	-53.1(5)
N2-C2A-C2-OT	-31.8(5)
C2A-C2-OT-CT1	-178.5(4)
C2-OT-CT1-CT2	-59.4(6)
C2-OT-CT1-CT4	67.2(6)
C2-OT-CT1-CT3	-176.9(4)

 Table S10.
 Selected torsion angles [°] for Z-L-Pro-Aib-OtBu.

	λ _{max} /nm		
	Band I	Band II	Band III
DMSO	276	316	378
Bidistilled water	272	310	370
Saline solution 0.9% w/v NaCl	261	312	
PBS	262	313	375
Cell culture medium + 10%	273	307	362
bovine fetal serum			

 Table S11. Main absorption band maxima (nm) recorded for IT03 in different solvents.

 $^{*}\!\lambda_{max}$ determined soon after dissolution

Table S12. Inhibition potency of selected compounds incubated (1 h for the Au(III) complexes, and 24 h for Cisplatin and Olaparib[®]) with purified PARP-1. Values expressed in terms of $IC_{50} \pm st.dev.$ (µM).

	$IC_{50} \pm st.dev (\mu M)$
IT03	0.017 ± 0.006
AuL12	0.019 ± 0.004
Cisplatin	12 ± 2
Olaparib®	0.00500 ± 0.00001



Figure S1. Schematic representation of the peptide bond formation using HOBt/EDC approach.



Figure S2. Schematic representation of the peptide bond formation using isobutylchloroformiate as a coupling reagent.



Figure S3. Resonance forms of the dithiocarbamic –NCSS⁻ moiety.



Figure S4. Different ways of metal-sulfur binding in dithiocarbamato complexes: symmetrical bidentate (a), asymmetrical bidentate (b) and monodentate (c).





Figure S6. ¹H-NMR spectra of IT01 in acetone-d₆ over 24 h.



Figure S7. [¹H,¹³C]-HMBC spectrum of IT01 in acetone-d₆.



Figure S8. Crystal packing of IT05-pentane viewed along the b crystallographic axis.



Figure S9. Depiction of intermolecular contacts between two symmetry related molecules of IT05 pentane. Symmetry code ' = 1/2-x; 1/2+y; z.



Figure S10. Crystal packing of IT03/IT04 acetone solvate viewed along the b crystallographic axis.



Figure S11. X-ray diffraction structure of Z-L-Pro-Aib-OtBu with atom numbering (only one position for the disordered C1G atom is shown; H-atoms have been omitted for clarity), characterized by a *cis* configuration of the Z-L-Pro urethane bond [the value of the OU-C0-N1-C1A torsion angle being -17.5(6)°], a not uncommon observation for urethane-protected Pro derivatives. The peptide backbone features a *semi*-extended conformation for the Pro residue [$\phi, \psi = -60.0(5)^\circ$, +168.8(3)°] while right-handed helical for Aib [$\phi, \psi = -53.1(5)^\circ$, -31.8(5)°]. Such a conformation is closely matched by the L-Pro-Aib segment in the structure of the racemate IT03/IT04. In the packing mode, an intermolecular H-bond is observed between the (peptide) N2-H group and the (*-x*, 1/2+*y*, 3/2-*z*) symmetry equivalent of the (urethane carbonyl) O0=C0 group, linking molecules related by a twofold screw axis along the *b* direction.



Figure S12. Electronic spectra of IT03 (50 µM) recorded in DMSO at 25°C for 24 h.



Figure S13. Electronic spectra of IT03 (50 μ M) recorded in deionized water at 25°C for 24h.



Figure S14. Electronic spectra of IT03 (50 µM) recorded in saline solution (NaCl 0.9% w/v) at 25°C for 24 h.



Figure S15. Electronic spectra of IT03 (50 µM) recorded in PBS buffer pH=7.4 at 25°C over 4 h.



Figure S16. Electronic spectra of IT03 (30 μM) in PBS added of 20% v/v complete medium (RPMI-1640 medium supplemented with 10% fetal calf serum) at 25°C for 24 hours.



Figure S17. Inhibition of PARP-1 activity by test compounds at different concentrations (from 10 to 0.01 μ M). For the assay each compound was incubated for 1 h with 0.5 U of purified protein.



Figure S18. Electronic spectrum of BSA and IT03 (equimolar, 30 µM) in PBS at 25°C over 24 h.



Figure S19. CD spectra of BSA incubated with IT03 at different molar ratios (from 0 to 3) in PBS at 25°C.



Figure S20. Fluorescence spectra of BSA (15 μ M) in presence of IT03 (15 μ M) in PBS at 25°C over 24h.



Figure S21. Intensity fluorescence at the λ_{em} maximum (349 nm) of BSA alone (\blacksquare) and when incubated with IT03 as a function of time (\bullet , 0-6 h).



Figure S22. Fluorescence spectra of BSA (15 μ M) in presence of IT03 at different molar ratios (from 0 to 3) soon after mixing, in PBS at 25°C.



Figure S23. Intensity fluorescence at the λ_{em} maximum (349 nm) of BSA alone (\blacksquare) and when incubated with IT03 at different IT03/BSA molar ratios (From 0.3 to 3; •).