liquor was evaporated to dryness and chromatographed by preparative tlc (CH_3OH–NH_4OH 97:3) to yield 0.016 g of **4a**. Compounds **1a**, **2a**, and **4a** were all identical with the compounds described above.

Examination of the aqueous phase by tlc showed the absence of any of the monomeric compounds, **6a** or **7a**. No other compounds could be isolated from this fraction.

Anodic Oxidation of 1b.—Compound **1b** was oxidized in the same manner as described above. After 12 hr, the reaction mixture was processed to yield a $CHCl_3$ extract.[29] The extract derived from the oxidation of 2.4 g of **1b** (four runs) was chromatographed over 200 g of silica gel using methanol–NH_4OH (99.75:0.25) as developer. Three fractions were obtained. The first fraction contained 0.23 g of starting material, **1b**. The second fraction contained 0.47 g of **4b**. The third fraction consisted of two compounds and was rechromatographed over neutral alumina using benzene–methanol (99:1) as a developer. The first fraction contained 0.104 g of the C–O–C trimer, **5b**. The developer was changed to benzene–methanol (49:1) and **2b** came off contaminated with **5b**. Preparative tlc yielded 0.016 g of the C–C dimer, **2b**. Compounds **1b**, **2b**, **4b**, and **5b** were identical with the compounds described above. No products could be isolated from the aqueous phase.

Anodic Oxidation of 1c.—Compound **1c** was oxidized as described above except that the medium consisted of 0.1 *M* $Na_2B_4O_7$–CH_3CN (7:3) rather than aqueous bicarbonate. The oxidation was carried out at +0.4 V. Periodically, the anode was removed and washed with acetone to remove the product coating it. After 24 hr, the reaction was stopped and the buffer mixture was extracted with $CHCl_3$. The $CHCl_3$ extract and the acetone washings from the electrode were combined and the solvent was evaporated. The residue was chromatographed over 150 g of silica gel using CH_3OH–NH_4OH (99.9:0.1) as developer. The first fraction contained 0.023 g of starting material, **1c**. The second fraction contained a mixture of the isomers of **4c** as described previously (0.176 g). The mixture was not separated. Compounds **1c** and **4c** were identical with the compounds described above.

(29) It was necessary to clean the electrode in HNO_3 frequently to keep the current at a reasonable level (30–40 mA).

Registry No.—**2b**, 25383-49-7; **4a**, 25383-50-0; **4b**, 19626-08-5; **4c**, 25383-52-2; **5b**, 25383-53-3; **7a**, 25383-54-4; **7b**, 25442-32-4; **7c**, 25383-55-5; 1-ethyl-7-hydroxy-6-methoxyisoquinoline, 25383-56-6.

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Tetraneurin-E and -F. New C-15 Oxygenated Pseudoguaianolides from *Parthenium* (*Compositae*)

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Three sesquiterpene lactones were isolated from *Parthenium confertum* var. *lyratum* (Gray) Rollins collected in Nuevo Laredo, Mexico. Two of the compounds, tetraneurin-E (**1**) and -F (**2**), are new C-15 oxygenated pseudoguaianolides, and their structure determinations are reported here; the third compound, tetraneurin-A, was previously isolated from *Parthenium alpinum* var. *tetraneuris* (Barneby) Rollins. *Parthenium integrifolium* L. yielded tetraneurin-E and tetraneurin-C (**3**), a compound previously isolated from a number of *Parthenium* species.

In a continuation of our chemosystematic investigation[1-3] of the genus *Parthenium*, a May 1969 collection of *Parthenium confertum* var. *lyratum* from Nuevo Laredo, Mexico, yielded two new sesquiterpene lactones, tetraneurin-E (**1**), $C_{17}H_{24}O_6$, mp 200–201°, $[\alpha]^{25}D$ −70.3°, and tetraneurin-F (**2**), $C_{19}H_{26}O_7$, mp 135–136°, $[\alpha]^{25}D$ −47.4°, and tetraneurin-A (**4**),[1] which was previously isolated from *Parthenium alpinum* var. *tetraneuris*. A 1969 collection of *Parthenium integrifolium* from near Cisco, Ill., also yielded tetraneurin-E (**1**) and the previously described tetraneurin-C (**3**).[2]

Tetraneurin-E (1) and -F (2).—The uv, ir, and nmr data for tetraneurin-E (**1**) and -F (**2**) indicated that both were pseudoguaianolides with structural features similar to the C-15 oxygenated compounds which had been previously isolated from other *Parthenium* species [hysterin (**5**)[4] tetraneurin-A (**4**)[1] and conchosin-A and -B[3]]. The presence of an α,β'-unsaturated γ-lactone ring, an acetate function, and a tertiary hydroxyl group in tetraneurin-E (**1**) was evident from the following data: λ_{max} 212 nm (ϵ 10,000); ir bands at 1730, 1750, and 3500 cm^{-1} (the latter was still observed after acetylation); the nmr spectrum in deuterated acetone exhibited signals typical for protons associated with a lactone function (see Table I). Although the nmr spectrum of tetraneurin-E displayed a three-proton singlet at 0.83,[5] typical for a C-5 tertiary methyl group, a doublet for a C-10 secondary methyl group was missing. Instead the spectrum displayed a two-proton multiplet at 3.75, which could be attributed to the presence of a C-10 CH_2OH group. An acetate three-proton singlet occurred at 1.99.

Treatment of the monoacetate tetraneurin-E (**1**) with acetic anhydride and pyridine yielded a diacetate which was identical in all respects with tetraneurin-F (**2**) and thus established that tetraneurin-E is the deacetyl analog of tetraneurin-F.

Treatment of tetraneurin-E with *p*-toluenesulfonyl chloride afforded a monotosylate, $C_{24}H_{30}O_8S$, mp 170–171°, whose structure appeared from nmr data to correspond to **6**. When compound **6** was refluxed with 2,6-lutidine it was converted into $\Delta^{10(15)}$-anhydrotetraneurin-E (**7**), $C_{17}H_{22}O_5$, mp 177–179°, whose 10,15-exocyclic double bond was evidenced on nmr by two

(1) H. Rüesch and T. J. Mabry, *Tetrahedron*, **25**, 805 (1969).

(2) H. Yoshioka, H. Rüesch, E. Rodriguez, A. Higo, J. A. Mears, T. J. Mabry, J. G. Calzada Alan, and X. A. Dominguez, *ibid.*, in press.

(3) A. Romo de Vivar, H. Aguilar, H. Yoshioka, A. Higo, E. Rodriguez, J. Mears, and T. J. Marbry, *ibid.*, in press.

(4) A. Romo de Vivar, E. A. Bratoeff, and T. Rios, *J. Org. Chem.*, **31**, 673 (1966).

(5) All chemical shift values are reported in parts per million, δ scale.

TABLE I

NMR DATA FOR TETRANEURIN-E AND -F AND DERIVATIVES[a]

Compd	H-2	H-4	H-6	H-7	H-9	C-5 Me	C-10 CH_2O or C-10 $=CH_2$	C-11 $=CH_2$	Acetyl Me	Other
1[b]		5.73 brd tr	5.17 d			0.83	3.75 m	5.55 d (J = 3.0)	1.99	
		(J = 8)	(J = 9)					6.05 d (J = 3.5)		
2		5.74 brd tr	5.18 d	3.38 m		0.87	4.30	5.50 d (J = 3.0)	2.06	
		(J = 7)	(J = 9)					6.20 d (J = 3.5)	2.09	
6		5.68 brd tr	5.13 d	3.33 m		0.72	4.22 m	5.42 d (J = 3.0)	2.07	2.47 (tosyl Me)
		(J = 7)	(J = 9)					6.16 d (J = 3.4)		7.42 and 7.85 d (J = 8.5 each) (aromatic)
7		5.74 dd	5.24 d	3.42 m		0.78	5.00 m	5.47 d (J = 3.0)	2.07	
		(J = 9 and 6)	(J = 9.0)					6.17 d (J = 3.5)		
8		4.75 m	5.46 d	3.45 m		0.71	5.00 m	5.53 d (J = 3.0)		
			(J = 9.5)					6.24 d (J = 3.5)		
9			4.75 d	3.50 m		0.94	5.03 and 5.12 brd each	5.63 d (J = 1.8)		
			(J = 7.5)					6.23 d (J = 2.3)		
10	5.73 brd tr	5.31 dd	4.32 d	3.40 m		1.08	4.14 brd d	5.54 d (J = 3.0)	2.06	
	(J = 2)	(J = 6 and 2.5)	(J = 8.5)				(J = 8)	6.25 d (J = 3.4)	2.03	
11		5.7 brd tr	5.20 d	3.45 m		0.85	4.45 m	5.56 d (J = 3.0)	2.10	3.08 (mesyl Me)
		(J = 7)	(J = 9.5)					6.21 d (J = 3.2)		
13		5.40 dd	4.48 d	3.30 m	5.81 tr	1.17		5.57 d (J = 2.2)	2.10	1.91 c (C10 Me)
		(J = 7 and 6)	(J = 8.5)		(J = 3)			6.27 d (J = 2.8)		

[a] Spectra were recorded in $CDCl_3$ on a Varian A-60 spectrometer unless otherwise stated. Values are given in parts per million (δ scale) relative to TMS as an internal standard. Numbers in parentheses denote coupling constants in cycles per second. Signals are singlets unless otherwise noted: d (doublet), dd (double doublet), tr (triplet), m (multiplet), c (complex), and brd (broad). [b] Recorded in acetone-d_6.

overlapped singlets at 5.00. Alkaline hydrolysis of compound **7** with aqueous K_2CO_3, gave the crystalline diol **8**, $C_{15}H_{20}O_4$, mp 145–147°. Oxidation of **8** with CrO_3–H_2SO_4 afforded a product, $C_{15}H_{18}O_4$, mp 204–205°, identical by melting point, ir, and nmr with dehydrocoronopilin **9**, previously prepared from tetraneurin-A (**4**)[1]. The correlation of tetraneurin-E with **9** established structure **1** for tetraneurin-E with the exception of the stereochemistry at C-10 and C-4.

The absolute configuration at C-4 in **8** (and thus in tetraneurin-E) was determined by the Horeau method.[6] After asymmetric esterification[7] of **8** with excess racemic α-phenylbutyric acid anhydride, (−)-α-phenylbutyric acid was recovered in an optical yield of 69%; this result indicated a β orientation for the C-4 oxygen function. The assigned stereochemistry at C-4 in tetraneurin-E (**1**) and -F (**2**) accorded with the observation that no increase in the intensity of the H_4 proton signal was observed upon NOE irradiation (Varian HA-100 spectrometer) at the nmr frequency of the C-5 methyl group of tetraneurin-F.

The stereochemistry at C-10[8] for both tetraneurin-E and -F was assigned as β since dehydration of tetraneurin-F with thionyl chloride gave as the major product compound **10** which contains a double bond between C-1 and C-2 (C-2 vinyl proton signal at 5.73 and a complex signal at 4.14 for the CH_2OAc function). This

(6) A. Horeau, *Tetrahedron Lett.*, 506 (1961).

(7) W. Herz and H. B. Kagan, *J. Org. Chem.*, **32**, 216 (1967).

(8) In connection with this aspect of the investigation an attempt was made to prepare a C_{15}-deoxy derivative of tetraneurin-E without altering the original C-10 stereochemistry. Tetraneurin-E was converted with methanesulfonyl chloride and pyridine to the mesylate (**11**). However, all attempts to transform **11** into the corresponding iodide (**12**) by treatment with sodium iodide in different polar solvents were unsuccessful. For example, the treatment of **11** with sodium iodide in acetonitrile yielded a compound whose spectral properties were compatible with formula **13** (see Table I).

result indicated[1,9] a *trans* relationship for the C-1 hydroxyl group and the C-10 CH_2OAc function; since the former is known to be α, the latter must be β. The evidence described above establishes that tetraneurin-E and -F correspond to structures **1** and **2**, respectively.

Experimental Section[10]

Isolation of Tetraneurin-A (4), -E (1), and -F (2) from *Parthenium confertum* var. *lyratum* (Gray) Rollins.—Air-dried and ground material (346 g) of *Parthenium confertum* var. *lyratum* (Gray) Rollins (voucher no. 277591)[11] collected in the summer of 1969 near Nuevo Laredo, Tamaulipas, Mexico, was extracted with $CHCl_3$ and worked up in the usual way.[1] The thick brownish syrup (15 g) obtained was dissolved in a minimum amount of $CHCl_3$ and left standing overnight. The crude crystals (2.3 g) which formed were filtered and recrystallized from acetone; yield 1.7 g of pure tetraneurin-E (1): mp 200–201°; $[\alpha]^{25}D$ −70.3° (*c* 0.55, MeOH); λ_{max} MeOH 212 nm (ϵ 10,000); ir bands (Nujol) 3500 (hydroxyl), 1750 and 1730 (carbonyls) cm^{-1}.

Anal. Calcd for $C_{17}H_{24}O_6$: C, 62.90; H, 7.41; O, 29.61. Found: C, 62.65; H, 7.35; O, 29.63.

The mother liquor from the crude crystals was evaporated and resultant residue was dissolved in ethyl acetate–cyclohexane; the solution was then left standing overnight in a refrigerator. A second crop of crystals (1.3 g) was found to be a 4:1 mixture of tetraneurin-A (4) and tetraneurin-E (1) (by nmr). Recrystallization of the crude material from ethyl acetate–cyclohexane yielded 800 mg of pure tetraneurin-A (4).

The tlc analysis (silica gel G) of the mother liquor from the second crop of crystals indicated the presence of a third, less polar substance. The crude syrup (1 g) obtained from the mother liquor was chromatographed over a silica gel (65 g) column packed in benzene. Elution of the column with benzene–acetone (6:1) in 15 ml fractions yielded in fractions 2–4 63 mg of tetraneurin-F (2): mp 135–136°; $[\alpha]^{25}D$ −47.4° (*c* 0.59, MeOH); λ_{max} (MeOH) 212 nm (ϵ 11,700); ir ($CHCl_3$), 3500 (hydroxyl), 1755 and 1725 (carbonyls), 1240 (acetate) cm^{-1}.

Anal. Calcd for $C_{19}H_{26}O_7$: C, 62.30; H, 7.35; O, 30.60. Found: C, 62.55; H, 7.35; O, 29.73.

Continued elution of the column afforded 100 mg of tetraneurin-E (1).

Isolation of Tetraneurin-E (1) and Tetraneurin-C (3) from *Parthenium integrifolium L.*—Air-dried and ground material (77.4 g) of *Parthenium integrifolium* (collected July 13, 1969, by A. G. Jones along the railroad tracks in Cisco, Piatt County, Ill.) was worked up in the usual manner: yield of crude syrup 1.1 g. The syrup was dissolved in $CHCl_3$ and the resultant solution was left overnight. Crude crystals (30 mg) were collected which yielded after recrystallization from acetone 20 mg of pure tetraneurin-E (1), mp 199–200°. Preparative tlc of the mother liquor yielded a compound which was identified as tetraneurin-C (3) by nmr analysis and cochromatography with an authentic sample.[2]

Tetraneurin-F (2) from Tetraneurin-E (1).—A solution of 200 mg of 1 in 1 ml of pyridine was mixed with 1 ml of acetic anhydride. The solution was kept standing overnight. After work-up of the solution in the usual way, a diacetate was obtained which was identical in all respects with tetraneurin-F (2) by mixture melting point determination and nmr and ir analysis.

Tetraneurin-E Tosylate (6) from Tetraneurin-E (1).—*p*-Toluenesulfonyl chloride (310 mg) was added to a solution of 250 mg of 1 in 2 ml of anhydrous pyridine and the solution was allowed to stand at room temperature for 15 hr. Water was added to the reaction mixture and the product was extracted with $CHCl_3$. The $CHCl_3$ layer was dried over Na_2SO_4, and the solvent was removed. The residue was recrystallized from $CHCl_3$–ether: yield 342 mg (92.4%) of the tosylate 6; mp 170–171°; ir ($CHCl_3$) 3470 (hydroxyl) and 1745 (carbonyl) cm^{-1}.

Anal. Calcd for $C_{24}H_{30}O_8S$: C, 60.20; H, 6.15; O, 26.75; S, 6.47. Found: C, 59.82; H, 6.49; O, 26.81; S, 6.68.

$\Delta^{10(15)}$-Anhydrotetraneurin-E (7) from Tetraneurin-E Tosylate (6).—A solution of 150 mg of 6 in 5 ml of freshly distilled 2,6-lutidine was heated under reflux (N_2 atmosphere) for 17 hr at 150°. The residue obtained on work-up was dissolved in $CHCl_3$ and the resultant solution was washed with 5% aqueous H_2SO_4 and then with aqueous $NaHCO_3$. Evaporation of the $CHCl_3$ and recrystallization of resultant crude crystals from $CHCl_3$–isopropyl ether yielded 84 mg of $\Delta^{10(15)}$-anhydrotetraneurin-E (7): mp 177–179°; ir ($CHCl_3$) 3500 (hydroxyl), 1750 and 1730 (carbonyls), 1250 (acetate) cm^{-1}.

Anal. Calcd for $C_{17}H_{22}O_5$: C, 66.75; H, 7.19; O, 26.18. Found: C, 66.77; H, 7.04; O, 26.44.

$\Delta^{10(15)}$-Deacetylanhydrotetraneurin-E (8) from $\Delta^{10(15)}$-Anhydrotetraneurin-E (7).—Compound 7 (100 mg) was dissolved in freshly distilled dioxane (3 ml) and then 50% aqueous K_2CO_3 (1 ml) and H_2O (3 ml) were added to the solution. The mixture was heated over a steam bath for 2 hr. The mixture was evaporated *in vacuo* and H_2O (3 ml) was added to the residue. The aqueous solution was acidified (10% H_2SO_4) and then saturated with $(NH_4)_2SO_4$. The solution was next extracted three times with ethyl acetate. Evaporation of the ethyl acetate *in vacuo* gave a residue which was preparatively chromatographed on silica gel G plates (ethyl acetate–benzene, 5:3). A major band (R_f 0.49) afforded material which yielded after recrystallization from isopropyl ether–ethyl acetate 28 mg of the pure diol 8: mp 145–147°; ir (Nujol), 3500 (hydroxyl), 1750 (carbonyl), 1656 and 1637 (C=C bonds) cm^{-1}.

Anal. Calcd for $C_{15}H_{20}O_4$: C, 68.16; H, 7.58; O, 24.22. Found: C, 67.95; H, 7.43; O, 24.16.

10,15-Dehydrocoronopilin (9) from $\Delta^{10(15)}$-Deacetylanhydrotetraneurin-E (8).—A solution of 8 (15 mg) in 0.3 ml of acetone was treated with 4 drops of the CrO_3–H_2SO_4 reagent[12] at room temperature. After 1 min, the mixture was diluted with 2 ml of water and extracted with three 5-ml portions of $CHCl_3$. Work-up of the $CHCl_3$ solution yielded 12 mg of 9 (recrystallized from $CHCl_3$–ligroin), mp 204–205°, which was identical by nmr and ir with 10,15-dehydrocoronopilin (mp 204–205°) previously prepared from tetraneurin-A.[1]

$\Delta^{1(2)}$-Anhydrotetraneurin-F (10) from Tetraneurin-F (2).—A solution of 2 (50 mg) in 1 ml of anhydrous pyridine was treated at room temperature with 0.5 ml of thionyl chloride. After a few minutes the solution was evaporated *in vacuo* and the resultant residue was dissolved in 5 ml of $CHCl_3$. Work-up of the $CHCl_3$ solution yielded a crude oil (45 mg) whose tlc and nmr analysis indicated that the oil consisted mainly of compound 10. Purification of the oil over tlc (silica gel G; $CHCl_3$–ether, 5:1) afforded, after trituration with ether–cyclohexane, pure $\Delta^{1(2)}$-anhydrotetraneurin-F (10): yield 40 mg; mp 104–105°; ir ($CHCl_3$) 1755 and 1730 (carbonyls), 1240 (acetate), 865 (trisubstituted ethylene group) cm^{-1}.

Anal. Calcd for $C_{19}H_{24}O_6$: C, 65.50; H, 6.90; O, 27.60. Found: C, 65.31; H, 7.01; O, 27.45.

Asymmetric Esterification of $\Delta^{10(15)}$-Deacetylanhydrotetraneurin-E (8) with (±)-α-Phenylbutyric Acid Anhydride and Pyridine.—A solution of 45 mg of 8 in 189 mg of α-phenylbutyric acid anhydride was mixed with 1.5 ml of pyridine. The solution was allowed to stand overnight at room temperature and was then worked up in the standard manner:[6,7] yield 153 mg of crystalline α-phenylbutyric acid, $[\alpha]^{24}D$ −10.8° (*c* 1.53, benzene). Fully stereospecific esterification should yield $[\alpha]^{24}D$ −95.6°/[2(3.58) − 1] = −15.6°; therefore, the optical yield is 68%.

Tetraneurin-E Mesylate (11) from Tetraneurin-E (1).—An ice bath cooled solution of 1 (404 mg) in 2 ml of dry pyridine was treated with 0.8 ml of methanesulfonyl chloride. After 10 min the solution was evaporated *in vacuo* and the resultant residue was dissolved in 5 ml of $CHCl_3$. Work-up of the $CHCl_3$ solution yielded a residue which crystallized on trituration with isopropyl ether to give 11: yield 530 mg; mp 164–165° (after recrystallization from $CHCl_3$–benzene); ir ($CHCl_3$) 3450 (hydroxyl), 1745 and 1725 (carbonyls) cm^{-1}.

Anal. Calcd for $C_{18}H_{26}O_8S$: C, 53.75; H, 6.46; O, 31.84; S, 7.96. Found: C, 53.68; H, 6.42; O, 31.96; S, 7.95.

Compound (13) from Tetraneurin-E Mesylate (11).—A mixture containing 100 mg of 11 and 350 mg of sodium iodide in 3 ml of acetonitrile was heated under reflux for 21 hr. Work-up of

(9) A. Romo de Vivar, L. Rodriguez-Hahn, J. Romo, M. V. Lakshikantham, R. M. Mirrington, J. Kagan, and W. Herz, *Tetrahedron*, **22**, 3279 (1966); (b) J. Kagan and H. B. Kagan, *J. Org. Chem.*, **33**, 2807 (1968).

(10) Melting points are uncorrected. Analyses were determined by Dr. Alfred Bernhardt, Mikroanalytisches Laboratorium, Elbach über Engelskirchen, West Germany.

(11) This voucher specimen is deposited in the University of Texas at Austin Herbarium.

(12) C. Djerassi, R. R. Engle, and A. Bowers, *ibid.*, **21**, 1548 (1956).

the acetonitrile solution (after filtration) gave an oil which was chromatographed over tlc plates (silica gel G; benzene–ethyl acetate, 4:1). A band (R_f 0.65) afforded **13** as an oil which did not crystallize after long standing: yield 30 mg; ir bands ($CHCl_3$) 3450 (hydroxyl), 1750 (carbonyl), and 1250 (acetate) cm^{-1}. The nmr spectrum (Table I) indicated that the substance was pure and clearly indicated a vinylic methyl group as shown in the formula of **13**.

Registry No.—**1**, 25383-30-6; **2**, 25383-32-8; **6**, 25383-33-9; **7**, 25383-34-0; **8**, 25383-35-1; **9**, 22555-70-0; **10**, 25383-37-3; **11**, 25383-31-7; **13**, 25383-38-4.

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Tumor Inhibitors. LVI.[1a] Cucurbitacins O, P, and Q, the Cytotoxic Principles of *Brandegea bigelovii*[1b]

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An ethanolic extract of *Brandegea bigelovii* Cogn. was found to have significant activity against human carcinoma of the nasopharynx (KB). Systematic fractionation of the extract led to the characterization of the major active principles as the new tetracyclic triterpenes cucurbitacin O (**1a**), cucurbitacin P (**3a**), and cucurbitacin Q (**2**). The structures were deduced from their formulas and spectra, and the relationships were confirmed by conversion of both **1a** and **2** to **3a**. Interrelation of **3a** with the known cucurbitacin B confirmed the structure and stereochemistry of **3a** at all positions but C-3 and C-20. Conversion of **3a** to a 2,3-acetonide showed it to be the 3α-hydroxy isomer of dihydrocucurbitacin F. The mass spectra of these compounds have been studied and are discussed.

In the course of a continuing search for tumor inhibitors of plant origin, an ethanolic extract of *Brandegea bigelovii* Cogn. (*Cucurbitaceae*)[3] was found to show significant activity against human carcinoma of the nasopharynx carried in cell culture (KB).[4] We report herein the systematic fractionation of the crude extract and the characterization of the three major cytotoxic principles as the new tetracyclic triterpenes cucurbitacin O (**1a**), cucurbitacin P (**3a**), and cucurbitacin Q (**2**).

The dried stems, leaves, flowers, and fruit of *B. bigelovii* Cogn. were continuously extracted with ethanol and the crude extract (A) was partitioned into a water-soluble fraction (B) and a chloroform-soluble fraction (C). The activity was concentrated into the latter, which was partitioned between petroleum ether (D) and aqueous methanol (1:9, E). The active fraction E was chromatographed on silica gel and successive elution with chloroform and 3 and 4% methanol in chloroform gave two active fractions (F and G, respectively, Table I).

Further chromatography of fraction G on silica gel gave a fraction which was crystallized from acetone to yield colorless crystals (H), mp 226–227°. A study of the mass spectrum and the elemental analysis suggested that H was a mixture of two similar compounds, $C_{30}H_{46}O_7$ [*m/e* 518 (M^+) and 500 ($M^+ - 18$)] and $C_{30}H_{48}O_7$ [*m/e* 520 (M^+) and 502 ($M^+ - 18$)]. On tlc two overlapping spots were present, the less polar of which absorbed ultraviolet light and thus probably contained a conjugated system. The infrared spectrum, 5.90, 5.94, and 6.14 μ, and ultraviolet spectrum, λ_{max} 230 mμ (ε 5500), indicated the presence of an α,β-unsaturated ketone, but the intensity of the ultraviolet absorption was unusually low.

TABLE I
CYTOTOXICITY OF FRACTIONS AND COMPOUNDS FROM *B. Bigelovii* AGAINST EAGLE'S KB STRAIN OF HUMAN CARCINOMA OF THE NASOPHARYNX

Fraction	ED_{50}, μg/ml	Compd	ED_{50}, μg/ml
A	2.70	**1b**	20
B	>100	**2**	0.032
C	0.61	**3a**	0.54
D	>100	**3b**	45
E	0.21	**4**	2.9
F	0.021		
G	0.20		
H	0.24, **1a**–**3a** (1:1)		
I	0.19, **1a**–**3a** (3:1)		

Although no work has previously been reported on *Brandegea* species, other members of the family *Cucurbitaceae* have yielded cucurbitacins, a series of highly oxygenated tetracyclic triterpenes which often contain α,β-unsaturated ketones in their side chains. A number of the cucurbitacins have been shown to have cytotoxic properties.[5–7]

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