

(6a), mp 25–35°, was obtained from 3a in 60% yield and was converted to its tris(hydroxymethyl)aminomethane (THAM) salt,¹² mp 100–101°. Both PGF_{2α} and its THAM salt were identical with authentic materials.

Utilization of the (15*R*)-PGA₂ diester (1b) from coral as a precursor of PGE₂ and PGF_{2α} requires an inversion of configuration at C-15.¹¹ For the synthesis of PGF_{2α}, 1b was carried through the same sequence as above giving the corresponding intermediates 2b, 3b, and 5b. On hydrolysis 5b gave 6b, the 15-epimer of PGF_{2α}.

Selective oxidation with 2,3-dichloro-5,6-dicyano-1,4-benzoquinone¹³ gave ketone 7 (λ_{max} 234 nm (ε 11,850)) which was reduced by zinc borohydride in dimethoxyethane¹⁴ after temporary protection of the hydroxyl groups by trimethylsilylation, giving a 73:27 ratio of PGF_{2α} (6a) and its 15-epimer 6b.

(15*R*)-PGA₂ methyl ester (8b), also available from coral, was treated with methanesulfonyl chloride in pyridine and the resulting crude 15-mesylate was solvolyzed in acetone–water to give modest yields of the C₁₅ inverted product, (15*S*)-PGA₂ methyl ester (8a), along with some 8b and several other products. Acetylation of 8a in acetic anhydride–pyridine gave 1a and thus ultimately PGE₂ and PGF_{2α}.

Plexaura homomalla, var. (*R*) and var. (*S*), are thus both suitable sources of (coral) prostaglandins useful in the synthesis of PGE₂ and PGF_{2α}. From the (*S*) variety, PGE₂ can be obtained in three steps and PGF_{2α} in four steps.

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Isolation of a New Naturally Occurring Prostaglandin, 5-*trans*-PGA₂. Synthesis of 5-*trans*-PGE₂ and 5-*trans*-PGF_{2α}

Sir:

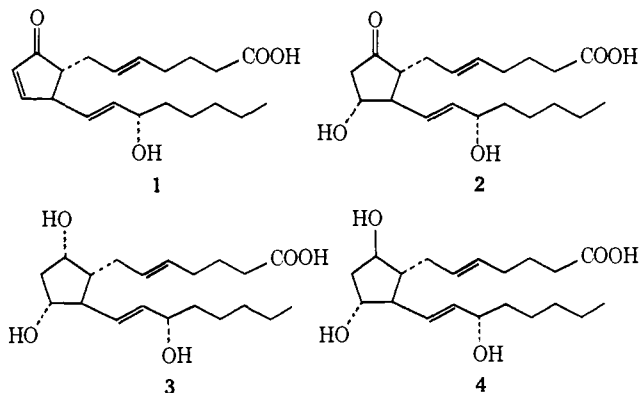
During the chromatographic purification of (15*S*)-PGA₂ obtained from the gorgonian *Plexaura homomalla* var. (*S*),¹ a new natural prostaglandin was detected which was chromatographically less polar than PGA₂ on silver nitrate impregnated silica gel. We report here the purification of this material, its structure elucidation, and confirmation of the structure by chemical transformations.

Column chromatography of crude (15*S*)-PGA₂ on Amberlyst-15 Ag⁺ form² or on silver nitrate impregnated silica gel gave a minor component to which the structure (15*S*)-15-hydroxy-9-oxo-5-*trans*,10,13-*trans*-prostatrienoic acid (5-*trans*-PGA₂) (1) is assigned. Content of the *trans* isomer usually ranged between 5 and 15% of the PGA₂ present. 5-*trans*-PGA₂ is an oil [λ_{max} 217 nm (ε 9050); [α]_D +128° (CHCl₃); molecular ion at 478.2998 for TMS derivative (calcd for

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C₂₆H₄₆O₄Si₂, 478.2932); mass spectrum identical with that of PGA₂]. Conversion of 1 to the β-ketol was effected by a modification of the epoxidation–reduction sequence³ to give (15*S*)-11α,15-dihydroxy-9-oxo-5-*trans*,13-*trans*-prostadienoic acid (5-*trans*-PGE₂) (2)⁴ together with the 11β isomer. 5-*trans*-PGE₂ was crystalline: mp 76–77° (*Anal.* Found: C, 68.52; H, 9.23); [α]_D –66° (c 0.983, ethanol); mass spectrum identical with PGE₂. After conversion to a trimethylsilyl (TMS) derivative, reduction of 2 with sodium borohydride⁵ and hydrolysis gave a mixture of (15*S*)-9α,11α,15-trihydroxy-5-*trans*,13-*trans*-prostadienoic acid (5-*trans*-PGF_{2α}) (3) and (15*S*)-9β,11α,15-trihydroxy-5-*trans*,13-*trans*-prostadienoic acid (5-*trans*-PGF_{2β}) (4),



which were separated by silica gel chromatography. 5-*trans*-PGF_{2α} was crystalline: mp 94.8–95.8° (*Anal.* Found: C, 67.99; H, 9.64); [α]_D +9° (ethanol); mass spectrum *m/e* at 354 (M⁺), 336, 318, 264, 247, 191, 137. 5-*trans*-PGF_{2β} was also crystalline: mp 68–69° (*Anal.* Found: C, 67.89; H, 9.78); [α]_D –8° (ethanol).

Irradiation of prostaglandin E₂ in oxygen-free benzene–methanol solution with 3500-Å light for 24 hr in a Rayonet photochemical reactor in the presence of diphenyl sulfide^{6,7} gave, after careful chromatography on acid-washed silica gel, a 22% yield of 5-*trans*-PGE₂, mp 75–77°, which was identical with the material derived from *P. homomalla*. In a similar fashion and in similar yield, crystalline 5-*trans*-PGF_{2β} and 5-*trans*-PGF_{2α} were prepared from the corresponding 5-*cis*-prostaglandins and were also identical with the coral-derived compounds.

A reexamination of the extracts of *P. homomalla* var. (*S*) prior to hydrolysis shows that, while small amounts of the free acids are present, the 5-*trans* isomer is predominantly in the form of its 15-acetate methyl ester. It is not clear at this time whether the presence of this isomer represents biosynthetic formation from 5-*trans*-arachidonic acid endogenous to *P. homomalla*, or a subsequent transformation product of 5-*cis*-PGA₂.

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