Metabolism of Prostaglandins E, A, and C in Serum*

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SUMMARY

Three prostaglandin-metabolizing enzymes were detected in human serum. One enzyme was a dehydrase that converted prostaglandin E to prostaglandin A, the second was a prostaglandin A isomerase that converted prostaglandin A to prostaglandin C and the third was a prostaglandin C isomerase that converted prostaglandin C to prostaglandin B. All three were inactivated by sulfhydryl blocking agents. In human serum, only prostaglandin C isomerase had high activity, whereas the other two enzymes had very low activity. In rabbit serum both isomerases were very active, but dehydrase activity could not be detected. Prostaglandin C isomerase activity was also found in crystallized human serum albumin and rabbit serum albumin.

In recent years, the biosynthesis, catabolism, and interconversion of prostaglandins have been widely studied. However, knowledge of their metabolism in biological fluids, which is important for the determination of prostaglandin levels, has remained inadequate. Until their fate in these fluids is elucidated, the measurements will continue to be controversial.

It has been established that PGE and PGF, when present in blood, are rapidly metabolized by a dehydrogenase in the lung during pulmonary circulation (1, 2). No dehydrogenase activity has been detected in serum or plasma (2, 9), and PGF has been completely recovered after incubation in human serum (3). Contradictory results have been published concerning the fate of PGE in serum. Several investigations indicate that no metabolism of PGE occurs in blood or plasma (1, 2, 4, 5), and other results show a slow loss of PGE when incubated with human (6), bovine, or dog plasma (7, 8). Recently McDonald-Gibson and McDonald-Gibson (9) reported an enzyme in human plasma that rapidly metabolizes PGE. The metabolite co-chromatographed with PGA on thin layer chromatography. This enzymatic conversion of PGE to PGA has also been reported for several tissues (10, 11).

The occurrence of PGA and its biological role are not yet understood. In early publications, Hamberg and Samuelsson (12) identified PGA and many other prostaglandins in the seminal fluid of several species, including man, and PGA was detected in rabbit (13) and in human kidney (14). The conversion of PGA to PGB in the sera of several species has been reported (15-17). Jones subsequently identified the product of this isomerase to be PGF (18). Since PGC is very unstable, it may be difficult to detect it in extracts of tissue homogenates and biological fluids. Its conversion to PGB is alkalai- and acid-catalyzed (19) but occurs at a measurable rate even at pH 7 (18). Thus, it is not surprising that PGB was initially reported to be the product of the PGA isomerase. Previously, this enzyme could not be detected in human serum or plasma (16, 17). With an improved technique, we obtained results showing PGA isomerase activity in human serum. In addition, a dehydrase was detected in human serum and a third metabolizing enzyme, PGC isomerase which converts PGA to PGB, was measured. The three enzymatic activities in human and rabbit serum were compared.

EXPERIMENTAL PROCEDURE

Materials—Prostaglandins were purchased from Ono Pharmaceutical Co., Ltd., Osaka, Japan. PGA, a gift from Dr. J. Pike of the Upjohn Co., Kalamazoo, Mich., was also used. Trinitiated prostaglandins were purchased from New England Nuclear Corp., Boston, Mass. Sera were obtained from Grand Island Biological Co., Grand Island, N. Y. In addition, sera of man, rabbit, dog, rat, and mouse were prepared from fresh blood. Other chemicals were obtained from the following companies: rabbit albumin (crystallized) from Sigma and Pentax (for isoelectric focusing of Sigma and Pentax for isoelectric focusing rabbit albumin from Sigma was used); human albumin and bovine albumin (crystallized) from Pentax; rabbit γ-globulin (Fraction II) from Hyland; ovalbumin from Miles; ribonuclease from Worthington; β-lactoglobulin was a preparation made in Dr. S. N. Timasheff’s laboratory at Brandeis University; human mercaptoalbumin was a generous gift from Dr. K. Schmid, Boston University, School of Medicine; pepsin (porcine, Grade B) from Calbiochem; iodoacetate from Eastman; N-ethylmaleimide and p-mercuribenzoate from Sigma; and Fillman’s reagent (5,5’-dithiobis(2-nitrobenzoic acid)) from Aldrich.

Radioimmunoassay—The preparation of antibodies to PGB1, PGF1,1, and PGF3, and the procedure of the radioimmunoassay
have been described (20). [3H]PGB1 was made from [3H]PGE1 and unlabeled PGB1 was made from PGE1 at pH 12 (20, 21). PGE1 was reduced to PGF1 with NaBH4 (22) at pH 10 for 2 to 3 hours at room temperature. An excess of sodium pyruvate was then added and the solutions were neutralized.

**Enzyme Assay**—This assay was performed in Tris buffer (0.01 M Tris HCl, 0.02 M NaCl) at pH 7.2. The pH of the serum was adjusted to this value with HCl when necessary. The reaction mixtures were incubated at 37°C. The reaction was stopped by transferring the mixtures into an ice bath. The solutions were then diluted with cold Tris buffer to the desired inhibitor concentration.

**Isoelectric Focusing**—This was performed in the LKB 8101 column with a volume of 110 ml, according to the instructions.

**Pepsin Digestion**—Digestion was performed at pH 2.5 for 1 hour after reduction of PGE1 to PGF1, which was easily detected. If the enzymatically generated PGB1 were further converted to PGB2 by PGF1 to PGB1 could easily be detected. If the enzymatically generated PGB1 or PGB2 could result in increased inhibition of the binding of [3H]PGB1 to the antibody. The inhibition by mixtures of PGB1 plus PGB2 of various compositions, but at a constant amount of total prostaglandins, is shown in Fig. 1. The calibration curve was also determined in the presence of rabbit albumin, which slightly increased the inhibition by PGB1, but not PGB2 (2). These calibration curves were used to determine the amount of PGB1 in the presence of PGA1 and/or PGB1. The method is sensitive and accurate enough to allow for the measurement of initial rates of formation of product. If more than 30 to 40% PGB1 is present, the method becomes less sensitive.

The conversion of PGE1 to PGA1 was also followed with PGB1 antiserum. The inhibition by 20 ng of PGE1 was ~50%, but 1 ng of PGA1 inhibited 20%. Thus, a conversion of 5% of PGE1 to PGA1 could easily be detected. If the enzymatically generated PGA1 (or PGB1) were further converted to PGB1 by isomerases, the increased inhibition would reflect a mixture of PGA1 and PGB1 of unknown quantity and composition, and only qualitative information about the conversion of PGE1 to PGA1 could be obtained with this antiserum. We can, however, measure quantitatively the disappearance of PGE1 instead of the appearance of PGB1 by chemically reducing PGE1 to PGF1, which could then be measured with antibodies directed toward PGB1. After reduction, PGA was not bound to a measurable extent to the antibodies. Thus, the amount of PGB1 present could be obtained directly from the inhibition curves. For 50% inhibition of the PGB1 system and the PGB2 system, 1.5 ng of PGB1 and 3 ng of PGB2, respectively, were required (3). This measurement was less sensitive than that of the appearance of PGB1, since inhibition decreased only 10 to 20% with the disappearance of 50% of the PGE1.

**Prostaglandin Metabolism in Serum—Isomerase and dehydrase activities in human and rabbit serum**—Isomerase and dehydrase activities in human and rabbit serum are shown in Fig. 2. The influence of rabbit albumin on the inhibition depends on the amount of rabbit albumin present in the radioimmunoassay and is not altered when PGA is incubated with rabbit serum at 37°C. Thus, we concluded that this effect does not reflect an enzymatic conversion of PGA to PGB. It may reflect the binding of PGA to albumin.
The appearance of product (or the disappearance of substrate) was independent of the substrate concentration over the range studied. It is expressed in per cent of the initial substrate concentration.

Isomerase activities are shown in Fig. 2A. Rabbit serum, diluted 10-fold, converted 50% of PGA₁ to PGB₁ in 30 min and 10% of the substrate in less than 5 min. Undiluted human serum converted only 10% of the substrate in 3 hours. Even though this rate is very slow, it is clear that the PGA₁ is converted to PGB₁ in human serum. PGA₁ is stable in buffer.

Dehydrase activities are shown in Fig. 2B. In human serum enzymatic activity was measured as the rate of disappearance of PGE₁. In 4 hours about 30% of the substrate had disappeared. In similar experiments with anti-PGB₁, antiserum inhibition increased, indicating the formation of PGA₁ or PGA₁ plus PGB₁. (Other known metabolites of PGE, such as 15-keto-PGE and 13,14-dihydro-15-keto-PGE, would have inhibited the radioimmunoassay binding less than PGE₁.) In rabbit serum we could not detect any dehydrase activity. The loss of PGE₁ was 2 to 5% in 4 hours, the same as in buffer controls. In the experiments with rabbit serum, dehydrase activity was measured as the appearance of PGB₁, since any PGA₁ formed from PGE₁ would rapidly have been converted to PGB₁ by the isomerase in rabbit serum, thus amplifying the detection of dehydrase activity. Essentially the same results were obtained when the disappearance of PGE₁ was measured.

PGC Isomerase—The rapid appearance of PGB₁ upon incubation of PGA₁ in rabbit serum was surprising, since partially purified PGA₁ isomerase converts PGA₁ only to PGC₁, (24, 25), and the further conversion of this enzymatically formed PGC₁ to PGB₁ has been reported to be a slow chemical reaction (24, 25). Therefore, it appeared that rabbit serum not only catalyzes the conversion of PGA₁ to PGC₁ but also the second isomerization of PGC₁ to PGB₁. This reaction was further investigated. The spectra of PGA₁ and of the product of PGA₁ and 100-fold purified rabbit PGA₁ isomerase are shown in Fig. 3. From the molar absorption for prostaglandins in methanol (18), the reaction mixture was calculated to contain about 75% PGC₁, 20% PGA₁, and 5% PGB₁. The same amount of PGB₁ was calculated by radioimmunassay, but PGC₁ was not distinguished from PGA₁. If rabbit serum was added to this prostaglandin mixture the rate of formation of PGB₁ was accelerated.

A similar rate increase was observed when either human serum, human albumin, or rabbit albumin was added to the reaction mixture. As shown in Fig. 3, the amount of PGB₁ increased from 5% to only 15% when further incubated without any addition, whereas in the presence of HSA, it increased to 60%.

If the conversion of PGA₁ to PGC₁ was performed at the low concentration of partially purified PGA₁ isomerase, which is employed routinely when the prostaglandins are analyzed with the radioimmunassay, no PGB₁ could be detected. (For the spectroscopic analysis about 1000 times higher concentration of prostaglandins is required than for the radioimmunassay and correspondingly more enzyme has to be used.) However, in the presence of increasing concentration of rabbit albumin, increasing amounts of PGB₁ were formed (Table I). Depending on its concentration, bovine albumin also converted PGC₁ to PGB₁, but less so than rabbit albumin. Human mercaptalbumin catalyzed the reaction as well as human albumin. In the presence of other proteins (rabbit γ-globulin, ovalbumin, β-lactoglobulin, or ribonuclease), no PGB₁ was formed.

The slow conversion of PGC₁ to PGB₁ in the absence of albumin or serum could be observed only in the presence of a relatively high concentration of the partially purified PGA₁ isomerase. This enzyme preparation could have contained some of the factor that brings about the conversion of PGC₁ to PGB₁. The rate of the alkali catalyzed conversion reported by Jones et al. (24) and Jones and Cummock (25) was also measured in the presence of a partially purified isomerase, which may also have contained this factor. Jones et al. also reported that the isolated PGC₁ is converted to PGB₁ with a measurable rate at pH 7 (18), but the magnitude of this rate has not been reported. To eliminate any possible contribution to the conversion of PGC₁ to PGB₁ by proteins present in the partially purified PGA₁

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3 L. Levine, unpublished results.
4 We have purified the PGA₁ isomerase 120-fold from rabbit serum. Previously the PGA₁ isomerase from rabbit and cat serum had been purified 22- and 48-fold, respectively (24, 26).
isomerase was 6 × 10⁻⁸ M (20 µg per ml) which may well be too low a substrate concentration used for the dehydrase and the PGA isomerase present in rabbit serum. Thus, the concentration of substrate was higher in rabbit serum than in human serum. The rates of conversion of PGAl to PGCl is a much faster reaction, not contributing to the rate of the total reaction. In human serum, however, the slower step, the conversion of PGCl to PGB1, is rate-determining, whereas the first isomerization of PGAl to PGB1 is rate-determining, whereas the first isomerization of PGAl to PGCl, is independent of the substrate concentration. This was found for all three enzymes studied. The highest substrate concentration used for the dehydrase and the PGA isomerase was 0 × 10⁻⁴ M (20 µg per ml) which may well be too low to approach saturation. The PGC isomerase was studied at 100-fold lower substrate concentration.

The dependence of the rate of product formation on enzyme concentration for the PGC isomerase in human serum, human albumin, and rabbit albumin is shown in Fig. 7. Both albumin peaks had PGC isomerase activity corresponding approximately to the amount of protein present (Table III).

The PGC isomerase activity of rabbit albumin was not altered after removal of fatty acids from the albumin with charcoal (20). In an attempt to remove the enzyme activity from the albumin, rabbit albumin was subjected to electrophoresis. It focused in two peaks and tailed over a wide pH range (Fig. 5). This distribution can be accounted for by fatty acids bound in varied distribution. The sulfhydryl blocking agents used completely inactivated the dehydrase and the PGA isomerase; whereas the PGC isomerase of rabbit albumin was only partially inactivated. Incubation at pH 2.5 slightly reduced the activities, but after digestion with pepsin at pH 2.5 all activities were completely abolished. The sulphydryl blocking agents used inactivated all three enzymes.

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Table II

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Enzyme activity</th>
<th>% control</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Dehydrase</td>
<td>PGA isomerase</td>
</tr>
<tr>
<td>Dialysis</td>
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</tr>
<tr>
<td>Heating (20 min, 70°)</td>
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<tr>
<td>Incubation at pH 2.5</td>
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<tr>
<td>Pepsin digestion</td>
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<td>0</td>
</tr>
<tr>
<td>Incubation with N-ethylmaleimide, 1 × 10⁻² M</td>
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<td>+</td>
</tr>
<tr>
<td>Iodoacetate, 1 × 10⁻³ M</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>DTNB, 2 × 10⁻³ M</td>
<td>n.d.</td>
<td>+</td>
</tr>
</tbody>
</table>

* Human serum was diluted 1:10 and incubated with 20 µg of PGE₂ per ml for 20 hours at 37°. Remaining PGE₂ was reduced to PGE₃ and assayed with anti-PGF₁α.

† Human serum was diluted 1:10 and incubated with 20 µg of PGA₁ per ml for 20 hours at 37°. The solutions were then diluted 2000-fold and incubation was continued in the presence of PGC isomerase (rabbit albumin, 1 mg per ml) for 1 hour. This dilution resulted in concentrations of inhibitor which were too low to inhibit the PGC isomerase (20). The samples were assayed for PGB₁ with anti-PGB₁.

‡ PGG₁ was made from PGA₁ with partially purified rabbit PGA isomerase. The prostaglandins were removed from the proteins via dialysis. Human serum was diluted 1:10 and incubated with 500 µg of prostaglandin (70% of PGA₁, 20% of PGA₂, and 10% of PGB₁) for 5 min at 37°. The samples were assayed for PGB₁ with anti-PGB₁.

§ Human serum was diluted 1:10 and incubated in the presence of inhibitors for 1 hour at 37° before the addition of substrate. Inhibitors were used at high concentrations because of the low protein concentration (7 to 8 mg per ml). +, inhibition of enzyme activity ≥ 50%.

n.d., not determined.

Inactivation of Serum Enzymes—The results of various treatments on the activities of these three enzymes in human serum are summarized in Table II and on the PGC isomerase activity of rabbit albumin in Table III. Exhaustive dialysis did not alter the enzymatic activities. Heating for 20 min at 70° completely inactivated the dehydrase and the PGA isomerase; whereas the PGC isomerase of rabbit albumin was only partially inactivated. Incubation at pH 2.5 slightly reduced the activities, but after digestion with pepsin at pH 2.5 all activities were completely abolished. The sulphydryl blocking agents used inactivated all three enzymes.
TABLE III

Influence of various treatments of rabbit serum albumin on its PGC isomerase activity

Rabbit PGA isomerase purified 50-fold was incubated with 4 ng of PGA and 0.4 mg of rabbit albumin per ml for 1 hour at 37°. PGBi was assayed as described in the legend of Fig. 1.

<table>
<thead>
<tr>
<th>Treatment of rabbit albumin</th>
<th>PGC isomerase activity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>% control</td>
</tr>
<tr>
<td>Dialysis</td>
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<tr>
<td>Heating (20 min, 70°)</td>
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<td>Removal of fatty acids</td>
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<td>Incubation at pH 2.6</td>
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<td>Pepsin digestion</td>
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<tr>
<td>Incubation with DTNB</td>
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<td>1 x 10⁻³ M</td>
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<td>1 x 10⁻⁴ M</td>
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</tr>
<tr>
<td>1 x 10⁻⁵ M</td>
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</tr>
<tr>
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<td>1 x 10⁻⁴ M</td>
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<tr>
<td>Isoelectric focusing (see Fig. 5)</td>
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</tr>
<tr>
<td>Pool 1</td>
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</tr>
<tr>
<td>Pool 2</td>
<td>30</td>
</tr>
<tr>
<td>Pool 3</td>
<td>0</td>
</tr>
</tbody>
</table>

* Rabbit albumin (0.7 mg per ml = 1 x 10⁻⁶ M) was incubated with inhibitor at the given concentrations for 1 hour at 37°. PGA isomerase was incubated with PGA (10 ng per ml) for 1 hour at 37°. These two solutions were then combined and the incubation was continued for 1 hour (4 mg of prostaglandin and 0.4 mg of rabbit albumin per ml). We have shown that the partially purified rabbit PGA isomerase is inhibited only by N-ethylmaleimide (26).

The A₂₈₀ of the different pools in the incubation mixture was: Pool 1, 0.13; Pool 2, 0.04; and Pool 3, 0.014. The A₂₈₀ of rabbit albumin, 0.4 mg per ml, was 0.25.

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**Fig. 5.** Isoelectric focusing of rabbit serum albumin. Rabbit albumin (100 mg) (Sigma) was focused in a 1% LKB carrier Ampholyte solution, pH 4 to 6, with a linear sucrose density gradient for 65 hours at 550 to 600 volts. Two-milliliter fractions were collected. Samples were pooled as indicated.

**Fig. 6.** The rate of disappearance of PGE₂ in human serum as a function of enzyme concentration. PGE₂ (20 ng) was incubated with various amounts of serum in 1 ml of buffer for 20 hours at 37°. The amount of PGE₂ remaining was determined after reduction to PGE₁ with the PGE₁ antiserum. The values were corrected for the disappearance of PGE₂ in the buffer control (10 to 20%).

**Fig. 7.** The rate of conversion of PGC₁ to PGB₁ by human serum, human serum albumin, and rabbit serum albumin as a function of enzyme concentration. Prostaglandins (200 ng per ml: 70% PGC₁, 20% PGA₁, and 10% PGB₁; see Fig. 4 legend) were incubated at 37° with A, rabbit albumin (○) for 60 min; B, human serum (×) and human albumin (•) for 20 min. Prostaglandins were assayed for PGB₁, as described in the legend to Fig. 1. The values represent the average of two parallel determinations.
rates increased less than proportionally to the enzyme concentration. This was found for human serum diluted less than 50 fold and with human albumin and rabbit albumin concentrations higher than 1 mg per ml. If the albumin in human serum is assumed to be 50 mg per ml, the PGC isomerase activity in human serum is identical to the activity in purified albumin.

Enzyme Distribution—The distribution of the three enzymes in the serum of different species was determined (Table IV). Dehydrase activity in all sera was low. PGA isomerase activity was studied in the presence of PGC isomerase (rabbit albumin).

The formation of PGB from PGA by several sera without additional PGC isomerase (rabbit albumin) was also studied to test for the presence of endogenous PGC isomerase. PGB was formed without the additional PGC isomerase in the sera of all species that have PGA isomerase activity; thus all of these sera also have the second enzyme. With some species the amount of PGB increases when exogenous PGC isomerase is added. The magnitude of this increase was most striking for rabbit serum, which had the most active PGA isomerase. For those sera in which the formation of PGB did not increase after addition of PGC isomerase the activity of this second isomerase may be very high as for man. In the last three sera listed we could not obtain any information about PGC isomerase with this method, since no PGC isomerase was present to convert PGA to PGC. Bovine albumin, however, contains PGC isomerase; thus, it is most likely present in bovine serum.

In human serum, PGE is slowly converted to PGA, and PGA is slowly converted further to FGC. The next step in the reaction sequence, the isomerization of PGE to PGB, is a much faster reaction (Fig. 8). All conversions are enzymatic; this fact is supported by findings that the activities are not dialyzable. The enzymes are digested by pepsin and are inhibited by several sulfhydryl blocking agents. Before the levels of different prostaglandins in serum can be interpreted, these enzymatic activities must be taken into account.

Our results do not support the findings of McDonald-Gibson and McDonald-Gibson (9), who reported a very fast conversion of PGE to a less polar compound, possibly PGA, in human plasma. Whether our lower activity reflects differences between serum and plasma or between individual samples is not known at this time. McDonald-Gibson did report "high" activity in man. Since no PGA isomerase was present to convert PGA to PGC, the activity of this second isomerase may be very high as for man. In the last three sera listed we could not obtain any information about PGC isomerase with this method, since no PGC isomerase was present to convert PGA to PGC. Bovine albumin, however, contains PGC isomerase; thus, it is most likely present in bovine serum.

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albumin. It contains orle titratable sulfhydryl group per of the activity in human serum. Human mcrcaptalbumin, which is a much more homogeneous protein than nonmercaptalbumin crystallized human albumin could quantitatively account for all activity in both peaks. Lore information is needed to deter-

because of varied amounts of bound fatty acids, had enzyme 

tion, which was separated by electrofocusing into two peaks 

inactivated after incubation at 70°. A rabbit albumin prepara-

sulfhydryl blocking agents effectively inhibit the PGC isomerase. 

Like albumin, PGC isomerase is stable. It is only partially 

(28), has similar, if not identical, enzyme activity as human 

and we find this rate to be immeasurably slow over one hour at 

purified, does contain some PGC isomerase activity. The rate 

of the PGC to PGB conversion. Our enzyme, which is loo-fold 

some PGC isomerase which could have been responsible for most 

respective (24, 25) These preparations may have contained 

or 50.fold purified PGA isomerase from rabbit and cat serum, 

the PGA isomerase (PGA to PGC). The relative rates of the 

conversion (PGA to PGB) has now been compared with that of 

the sera of various species. We now know that these data 

represent the relative activities of the total conversion of PGA 

to PGB brought about by two enzymes. The rate of the total 

conversion (PGA to PGB) has now been compared with that of 

the PGA isomerase (PGA to PGC). The relative rates of the 

total conversion agree with our earlier data; rat serum has t,hc 

highest activity followed by rabbit serum. PGA isomerase, 

however, is most active in rabbit serum, whereas rat serum has 

50% of that activity. Rat serum was reported to have 5y0 of 

their presence in serum may also reflect their levels in organs or 

physiological conditions the enzymes arc activated. However, 

serum the dchydrase and the I'GA isomerase are present at very 

high levels of activity. Therefore, the physiological role of these 

enzymes in blood is not clear. It is possible that under certain 

physiological conditions the enzymes are activated. However, 

their presence in serum may also reflect their levels in organs or 

it may reflect certain conditions of these organs. Very little 

work has as yet been done concerning these enzymes in tissues. 

PGA may be a circulating hormone (26, 27), and its isomerase 

activity in human serum is low enough to allow for the transport 

of PGA. 111 the sera of many other species that contain active 

reaction (18), which has been measured in the presence of a 20-

PGA isomerase, however, transport of PGA is unlikely.

We reported earlier (17) the distribution of PGA isomerase in the 

sera of various species. We now know that these data 

activity in the sera of many other species that contain active 

isomerase, however, transport of PGA is unlikely.

The conversion of PGC to PGB was thought to be a chemical 

reaction (18), which has been measured in the presence of a 20-

or 50-fold purified PGA isomerase from rabbit and cat serum, 

respectively (24, 25). These preparations may have contained 

some PGC isomerase which could have been responsible for most 

of the PGC to PGB conversion. Our enzyme, which is 100-fold 

purified, does contain some PGA isomerase activity. The rate 

of conversion of isolated PGC to PGB has not been reported, 

and we find this rate to be immeasurably slow over one hour at 

37° at neutral pH.

It was surprising that the PGA isomerase activity found in 

crystallized human albumin could quantitatively account for all 

of the activity in human serum. Human mercaptalbumin, which 

is a much more homogeneous protein than nonmercaptalbumin 

(28), has similar, if not identical, enzyme activity as human 

albumin. It contains one titratable sulfhydryl group per 

molecule, and 5,5'-dithiobis(2-nitrobenzoic acid) and other 

sulfhydryl blocking agents effectively inhibit the PGC isomerase. 

Like albumin, PGC isomerase is stable. It is only partially 

inactivated after incubation at 70°. A rabbit albumin prepara-

tion, which was separated by electrofocusing into two peaks 

because of varied amounts of bound fatty acids, had enzyme 

activity in both peaks. More information is needed to deter-

mine whether PGC isomerase is a protein that is similar to or 

closely associated with albumin or whether albumin has isomerase activity.

REFERENCES


Metabolism of prostaglandins E, A, and C in serum.
H Polet and L Levine