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THE IDENTIFICATION AND CHARACTERIZATION OF AN UPTAKE SYSTEM FOR TAURINE INTO RAT LUNG SLICES

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Abstract—The objective of this study was to determine whether taurine was accumulated by rat lung slices and if so, to establish the role of this uptake as a source of pulmonary taurine. We have shown that taurine is accumulated into rat lung by an active uptake process that was both ATP and Na^+-dependent and obeyed saturation kinetics, exhibiting an apparent K_m of 186 μM and V_{max} of 970 nmol/g wet wt/hr. Substrate specificity of the system was high and only compounds possessing anionic and cationic groups separated by two methylene groups were able to competitively inhibit taurine uptake. Subsequent to its uptake, taurine was not significantly metabolized, and since the apparent K_m for the uptake process is similar to the known plasma concentration of taurine, it can be inferred that this system will contribute to pulmonary taurine uptake *in vivo*. Taurine has been suggested to possess antioxidant and antiinflammatory properties, and we suggest that this uptake system may contribute to the defence of pulmonary tissue against oxidative stress.

Taurine (2-aminoethanesulphonic acid) occurs at high concentrations in many tissues exposed to elevated levels of pro-oxidants [1–3] and, moreover, has been shown to exhibit antioxidant properties [2–7]. Its concentration in the lung approximates to 10 mM [8], although little is known of the source of this taurine. In many tissues, taurine represents the stable product of the metabolism of cysteine or cysteamine [2, 8–13]. We have previously shown that lung slices will metabolize cystamine to taurine, presumably via a cysteamine intermediate [14]. Cystamine is accumulated into the lung by a transport process previously shown to be responsible for the accumulation of selective polyamines, and the herbicide, paraquat [14, 15]. However, the significance of this transport system as a source of pulmonary taurine is dependent on the rate of delivery of taurine from other sources. One such source may be the direct accumulation of taurine from the circulation, since it is known that numerous tissues and cell types, including brain [16–18], kidney cortex [19], retina [20], Ehrlich ascites tumour cells [21], hepatocytes [22], blood platelets [23], lymphoblastoid cells [24] and neuroblastoma cells [25] possess active transport systems responsible for taurine uptake.

In this study, we have investigated the accumulation of [^{14}C]taurine into rat lung slices, and report that pulmonary uptake may occur through a system similar to those reported in other cell types. We also discuss the likely contribution of this transport system to the maintenance of the pulmonary taurine pool, in relation to taurine derived through the metabolism of cystamine.

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MATERIALS AND METHODS

Reagents. [U-^{14}C]Taurine (11.5 mCi/mmol) and [1,4-^{14}C]putrescine (109 mCi/mmol) were obtained from Amersham International Ltd (Amersham, U.K.). Soluene 350 (a tissue solubilizer) and Dimilume scintillation fluid were obtained from Packard Ltd (Poole, U.K.). Optiphase MP was obtained from FSA Laboratory Supplies Ltd (Loughborough, U.K.). KCN was purchased from BDH Ltd (Poole, U.K.), RbCl from Hopkin and Williams (Chadwell Heath, U.K.) and 3-isobutyl-1-methyl-xanthine from the Aldrich Chemical Co. Ltd (Gillingham, U.K.). Halothane (Fluothane) was obtained from ICI Pharmaceuticals (Macclesfield, U.K.). All other chemicals were obtained from the Sigma Chemical Co. (Poole, U.K.).

The uptake of taurine into lung slices. Slices of rat lung were prepared according to the method of Smith *et al.* [26]. Male Alpk:APfSD (Wistar-derived) specific pathogen free rats (body wt approx. 200 g) were killed by inhalation of an overdose of halothane (Fluothane), the lungs removed, and slices 0.5 mm thick prepared using a McIlwain tissue chopper. Slices (20–40 mg) were placed in 3 mL modified Krebs–Ringer phosphate medium (KRP) at pH 7.4 containing NaCl (130 mM), KCl (5.2 mM), $CaCl_2$ (1.9 mM), $MgSO_4$ (1.29 mM), Na_2HPO_4 (10 mM), and glucose (11 mM). [^{14}C]Taurine (0.04 μCi/3 mL) was made up to the required concentration with 10 mM unlabelled taurine. Incubations were carried out in a shaking water bath at 37° and 140 strokes/min for 30 min (unless otherwise stated). After incubation, the tissue was removed from the medium, blotted, and washed with 2 × 1 mL KRP. It was then dissolved in 1 mL Soluene 350, and 10 mL Dimilume

scintillation fluid was added. Also, an aliquot (0.1 mL) of the incubation medium was made up to 1 mL with water, and 10 mL Optiphase MP scintillation fluid added. In all cases, the radioactivity present was determined by liquid scintillation spectrometry. The slice to medium ratio was calculated as the ratio of ^{14}C present per unit weight of slice to that in an equal volume of medium. From this, the total concentration of ^{14}C label in the slice was calculated as [^{14}C]taurine equivalents, and corrected for non-specific uptake (measured as the uptake of label at 4°).

Nature of the radioactivity in the lung slice. Lung slices (30–50 mg) were incubated as described above for 60 min in KRP containing [^{14}C]taurine (100 μM). The tissue was removed into 1 mL 5% (w/v) trichloroacetic acid (TCA) on ice, homogenized, (Polytron vortex homogenizer) and left to stand at 4° for 30 min to ensure maximal protein precipitation. After centrifugation (20 min, 4°, 3000 *g*) the supernatant fraction was removed. An aliquot (20 μL) was spotted on to methyl-cellulose thin layer chromatography (TLC) plates along with a further 1.5 μL of a carrier solution of taurine (33 mg/mL). A [^{14}C]taurine standard was also spotted onto each plate, which were developed in a solvent system of ethanol/water/ammonia (80/16/4 v/v/v). A quantitative determination of the radioactive peaks on the plates was made using an Isomess IM3000 radio-TLC scanner.

The acid precipitated cellular material was washed three times each with 1 mL TCA (5% w/v), ethanol and ethanol/diethyl ether (1:1). The remaining precipitate was dissolved in 1 mL 1 M NaOH. An aliquot (0.5 mL) of the resultant solution was taken for analysis of its radioactive content by liquid scintillation spectrometry.

ATP measurements. Lung slices (20–40 mg) were incubated at 37° in KRP containing 2,4-dinitrophenol (100 μM), KCN (1 mM), antimycin A (0.1 μM), antimycin A (0.1 μM) in a gluclose-free medium or diamide (10 mM). After 15 and 45 min (corresponding to the lengths of preincubation, and incubation with taurine in the uptake studies), the slices were removed, blotted and washed with 2 × 1 mL KRP prior to removal into 3 mL 5% (v/v) perchloric acid/2.5 mM EDTA at 4°. The tissue was homogenized (Polytron vortex homogenizer) and centrifuged (MSE Micro Centaur, high speed, 10 min). The supernatant fraction was removed and its pH adjusted to 7.5 with 1 M KOH. Samples (5 μL) were taken in duplicate into 795 μL assay buffer (0.1 M Tris acetate, 2 mM EDTA pH 7.75) and assayed for ATP content using a commercially available kit (LKB Wallac, Turku, Finland). Briefly, this involves the measurement of the luminiscence produced by the ATP-dependent enzyme-catalysed oxidation of luciferin to oxy-luciferin. An internal ATP standard is also added to each sample such that quenching within the sample is overcome.

Cyclic AMP measurements. Lung slices (30–50 mg) were incubated in KRP medium at 37° in the presence or absence of 3-isobutyl-1-methyl-xanthine (500 μM) and forskolin (100 μM). After 15 and 45 min, the tissue was removed, blotted, and washed with 2 × 1 mL KRP prior to removal into 1 mL 5% (w/v) TCA at 4°. The tissue was dissociated by sonication (MSE sonicator) and centrifuged (MSE Micro Centaur, high speed, 2 min). The supernatant fraction was removed, the pH was adjusted to 7.5 with 20% (w/v) NaOH, and the total volume was made up to 2 mL with 0.05 M Tris buffer (pH 7.5) containing 4 mM EDTA. Samples (50 μL) were taken in duplicate and assayed for cyclic AMP using a commercially available competitive binding assay kit (Amersham International).

Non-protein sulphydryl (NPSH) measurements. NPSH levels were determined using the method of Sedlak and Lindsay [27]. Lung slices were incubated as described previously in the presence or absence of 10 mM diamide [Azodicarboxylic acid tris (dimethylamide)], and after washing were homogenized (Polytron vortex homogenizer) in 3 mL 5% (w/v) TCA/2.5 mM EDTA, and centrifuged (3000 *g*, 15 min, 4°). Aliquots of the supernatant fraction were taken in duplicate into 0.5 mL 5% (w/v) TCA/5 mM EDTA. Tris buffer (2.0 mL, 0.4 M, pH 8.9) and 50 μL 10 mM dithiobis (2-nitrobenzoic acid) (DTNB) were added, and the absorbance at 412 nm determined. The NPSH-content of the samples was measured against a standard curve using reduced glutathione as a standard.

Statistical analysis. Statistical analysis was performed using the Student's *t*-test for paired data. Significance was determined at $P < 0.05$.

RESULTS

Since previous studies had described taurine uptake into both platelets and lymphoblastoid cells [23, 24], an initial study was undertaken to investigate the effect of the removal of blood from the lungs on [^{14}C]taurine uptake. However, since its removal by saline perfusion resulted in no significant difference in the accumulation of radiolabel (Fig. 1), subsequent experiments were carried out using washed, but non-perfused lung slices.

Fate of taurine in the lung slice

Thin layer chromatography of the acid-soluble material from the lung slice and the uptake medium following 60 min incubation of the tissue with [^{14}C]taurine (100 μM) resulted in a single peak of radioactivity which co-chromatographed with a [^{14}C]taurine standard. Furthermore, only 0.5% of the ^{14}C-label became covalently associated with acid-precipitated material.

Uptake of taurine into the lung slice

[^{14}C]Taurine (1–1000 μM) was accumulated by rat lung slices by a process that was linear with time for 30 min at all concentrations. The system obeyed saturation kinetics, for which an apparent K_m of 186 μM and a V_{max} of 970 nmol/g wet wt/hr were derived (Fig. 2). This accumulation was significantly inhibited at 4° (Fig. 1).

Effect of metabolic inhibitors and changes in the ionic composition of the medium on taurine uptake

The relationship between pulmonary [^{14}C]taurine uptake and cellular ATP was investigated by treating

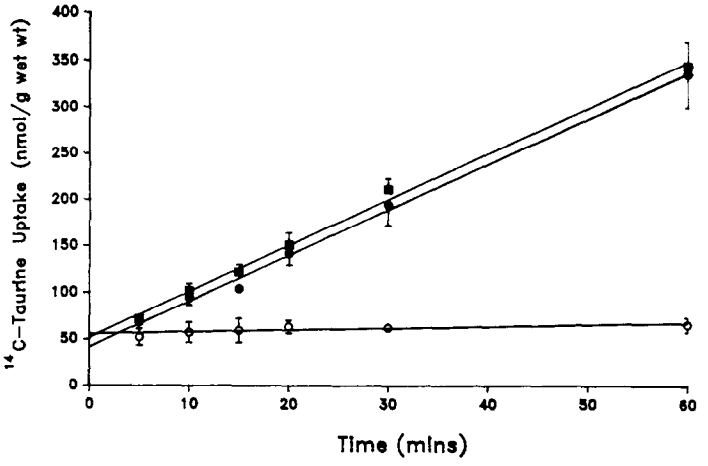

Fig. 1. Effect of saline perfusion or temperature on the uptake of [^{14}C]taurine by rat lung slices. Slices of rat lung were incubated in KRP medium containing [^{14}C]taurine (100 μM). The amount of ^{14}C-label accumulated at various time points was measured by radiochemical techniques. The results are expressed as the mean ± SE with six animals for each observation. (●—●) Untreated slices incubated at 37°; (■—■) slices from lungs, the blood removed by saline perfusion incubated at 37°; (○—○) untreated slices incubated at 4°.

slices with various metabolic inhibitors (Fig. 3). 2,4-Dinitrophenol (100 μM) did not significantly affect the uptake of [^{14}C]taurine, although cellular ATP levels were reduced by approximately 65%. However, KCN (1 mM), antimycin A (0.1 μM) and antimycin A (0.1 μM) in a glucose-free medium induced a greater depletion in ATP (85, 90 and 93%, respectively) and an associated decrease in [^{14}C]taurine uptake. Furthermore, diamide (10 mM), which produced the greatest decrease in ATP levels was also the most potent inhibitor of [^{14}C]taurine uptake (Fig. 3).

[^{14}C]Taurine uptake was significantly decreased in the presence of ouabain (100 μM), and was markedly inhibited by incubating the slices in KRP in which NaCl was replaced by RbCl (Table 1). Substitution of KCl, $CaCl_2$ or $MgSO_4$ by RbCl had no significant effect on [^{14}C]taurine uptake (Table 1).

Effect of structural analogues on taurine uptake

Since previous studies with other cell types had suggested that taurine uptake may occur via a β-amino acid transport system [16–18, 21, 24, 28], the inhibitory effect of known substrates of this system, and other structural analogues of taurine were tested on pulmonary [^{14}C]taurine accumulation. Of the compounds tested, only hypotaurine and β-alanine significantly inhibited [^{14}C]taurine uptake (Table 2). In both cases, the observed inhibition was competitive in nature as determined using a Hanes–Woolf plot (as Fig. 2) in which the slope of line for the substrate plus inhibitor was identical to that for substrate alone.

Effect of various drugs and other compounds on taurine uptake

Numerous other treatments have been reported to influence the accumulation of taurine by various tissues. Taurine uptake by kidney cortex is stimulated after incubation with dibutryl cyclic AMP (a cyclic AMP analogue which is resistant to degradation by phosphodiesterase) [29]. In the present study, cyclic AMP levels were increased from 2.27 ± 0.46 to 10.81 ± 0.45 and 52.90 ± 9.12 nmol/g wet wt by 3-isobutyl-1-methyl-xanthine (IBMX, 500 μM) and forskolin (100 μM), respectively, and to 82.39 ± 22.15 nmol/g wet wt by the two in combination. Although this elevation of cyclic AMP levels was maintained over 45 min in all cases, none of the treatments significantly altered [^{14}C]taurine uptake by lung slices (Table 3).

Chloroquine and chlorpromazine inhibit taurine accumulation into several tissues, including rat cerebral cortex and lymphoblastoid cells [2, 16, 24]. Both were found to inhibit [^{14}C]taurine uptake into lung slices (Table 3). However, at the same concen-

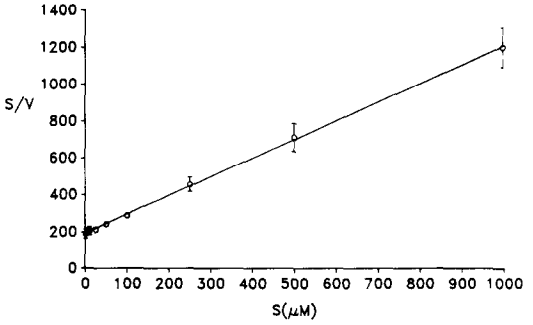

Fig. 2. Hanes–Woolf plot of [^{14}C]taurine uptake by rat lung slices. Slices of rat lung were incubated at 37° in KRP medium containing [^{14}C]taurine (1–1000 μM). The amount of radiolabel accumulated was measured after 30 min (over which time uptake at all concentrations was linear) by radiochemical techniques, and adjusted for non-specific uptake occurring at 4°. The results are expressed as the mean ± SE of 12 observations. The line was fitted to the points by non-weighted linear regression (correlation coefficient = 0.99).

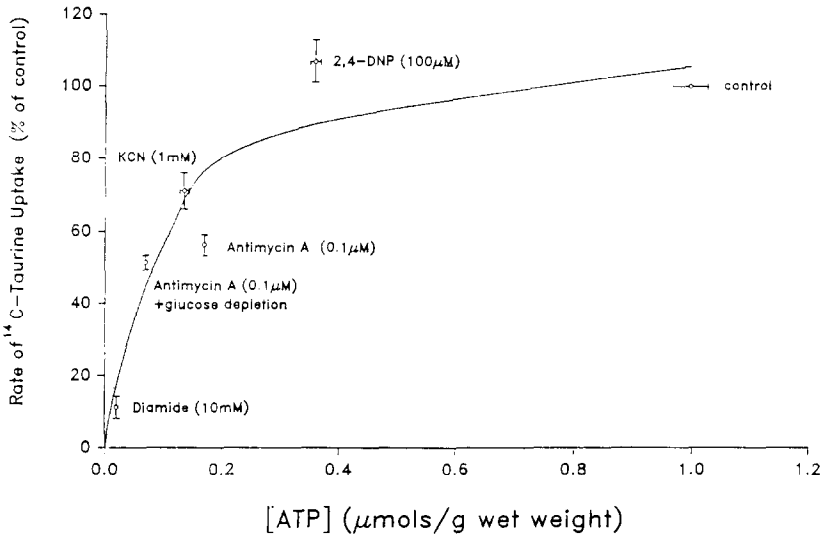

Fig. 3. Effect of ATP depletion on the uptake of [^{14}C]taurine by rat lung slices. Slices of rat lung were incubated for 15 min at 37° in KRP medium containing various metabolic inhibitors, prior to the addition of [^{14}C]taurine (100 μM). The amount of ^{14}C-label accumulated after a further 30 min was measured by radiochemical techniques, adjusted for non-specific uptake occurring at 4°. The ATP levels in similarly treated lung slices were measured by luminometric techniques using a commercially available ATP monitoring kit. In each case, it was shown that maximal ATP depletion was achieved by 15 min and was maintained over a further 30 min. In all cases, the results are expressed as the mean ± SE with six animals for each observation.

trations, these compounds also inhibited the accumulation of [^{14}C]putrescine into lung slices by 85 and 75%, respectively (data not shown).

Taurine uptake by rat kidney cortex is inhibited by the glutathione-oxidizing agent, diamide (10 mM) [19]. Pulmonary [^{14}C]taurine transport was inhibited by approximately 85% by 10 mM diamide (Table 3). However, although diamide (10 mM) treatment significantly reduced pulmonary non-protein sulphydryl levels (from 1.77 ± 0.07 to 0.87 ± 0.04 μmol/g wet wt), a 97% reduction in ATP levels was also noted (Fig. 3).

Table 1. The effect of cation-depletion or ouabain on the uptake of [^{14}C]taurine by rat lung slices

Treatment	[^{14}C]Taurine uptake (% of control)
Na^+-free	13 ± 0.7*
K^+-free	109 ± 11
Ca^{2+}-free/EGTA (1 mM)	93 ± 8
Mg^{2+}-free	110 ± 2
Ouabain (100 μM)	71 ± 9*

Lung slices were incubated at 37° for 30 min in Krebs-Ringer phosphate medium containing 100 μM [^{14}C]taurine under the above conditions. The metal ions were replaced by RbCl to maintain osmotic conditions. In the case of ouabain, the tissue was preincubated for 30 min prior to the addition of [^{14}C]taurine.

The accumulation of ^{14}C-label was measured by radiochemical techniques, and adjusted for non-specific uptake occurring at 4°. The results are expressed as the mean ± SE with six animals for each observation. Control = 348 ± 30 nmol/g wet wt/hr.

* $P < 0.05$.

DISCUSSION

In this study we have identified the presence of a taurine uptake system in rat lung slices and characterized this in relation to previously identified taurine transport systems in other tissues. This system has been shown to be characteristically different from previously described transport systems in the lung including the cystamine uptake process that can lead to the accumulation of taurine [14, 15].

[^{14}C]Taurine was accumulated into rat lung slices by a system that obeyed saturation kinetics, for which a K_m of 186 μM and a V_{max} of 970 nmol/g wet wt/hr were derived (Fig. 2). The observation that [^{14}C]taurine was not significantly metabolized by the lung slice and was not incorporated into cellular protein to any degree, implies that the accumulation of ^{14}C-label is mediated by a taurine transport system and is not a result of the intracellular metabolism of taurine derived by simple diffusion. This uptake system may well play a major role in taurine transport into the lung *in vivo*, since the plasma taurine concentration in the rat has been estimated to be between 50 and 200 μM [8].

Effect of metabolic inhibitors and changes in the ionic composition of the medium on taurine uptake

The uptake process appears to be active, since [^{14}C]taurine uptake was greatly reduced at 4° (Fig. 1). Furthermore, the use of metabolic inhibitors suggests that the process is dependent on cellular ATP, although a severe depletion in ATP appears necessary before a significant reduction in taurine transport is observed (Fig. 3).

The uptake of [^{14}C]taurine was dependent on extracellular Na^+, but not K^+, Ca^{2+} or Mg^{2+}, and

Table 2. The effect of structural analogues of taurine on the uptake of [^{14}C]taurine into rat lung slices

Compound	Structure	Inhibition of taurine uptake
Taurine	$^{+}NH_3—CH_2—CH_2—SO_3^-$	—
Hypotaurine	$^{+}NH_3—CH_2—CH_2—SO_2^-$	Competitive $K_i = 214\ \mu M$
β-Alanine	$^{+}NH_3—CH_2—CH_2—COO^-$	Competitive $K_i = 217\ \mu M$
γ-Aminobutyrate	$^{+}NH_3—CH_2—CH_2—CH_2—COO^-$	None
3-Aminopropanesulphonate	$^{+}NH_3—CH_2—CH_2—CH_2—SO_3^-$	None
Glycine	$^{+}NH_3—CH_2—COO^-$	None
Cysteate	$^{+}NH_3—CH(COO^-)—CH_2—SO_3^-$	None
α-Aminobutyrate	$CH_3—CH_2—CH(^{+}NH_3)—COO^-$	None
Isethionate	$HO—CH_2—CH_2—SO_3^-$	None
Ethanolamine	$^{+}NH_3—CH_2—CH_2—OH$	None

Lung slices were incubated at 37° for 30 min in Krebs–Ringer phosphate medium containing [^{14}C]taurine (25–500 μM) and test compound (0–500 μM). The rate of accumulation of ^{14}C-label was measured by radiochemical techniques, and adjusted for non-specific uptake occurring at 4°. Six animals were used for each observation. The nature of any observed inhibition was assessed by a Hanes–Woolf plot.

furthermore, was significantly inhibited by ouabain (Table 1). (The uptake of [^{14}C]putrescine, a process that is dependent on viable tissue [30] was unaffected by this treatment.) This suggests that uptake may be coupled to a Na^+-dependent ATPase, a finding that has been observed in other tissues [16–18, 20, 22–24, 31, 32].

Effect of structural analogues on taurine uptake

That both hypotaurine and β-alanine exerted a competitive inhibition with inhibition constants (K_i values) approximately equal to the K_m for [^{14}C]taurine, suggests that changes in the acid group (from sulphonate to sulphinate or carboxylate) do not greatly affect substrate binding. However, the lack of inhibition by isethionate and ethanolamine (in which the amino and sulphonate groups, respectively, of taurine have been replaced by a hydroxyl group), suggests that substrate binding has an absolute requirement for a positive and negative ionic grouping. Furthermore, the length of the alkyl chain between the anion and cation may also be critical in substrate binding, since only compounds with a 2-carbon chain (e.g. hypotaurine and β-alanine) exhibit an inhibitory effect. An increase or decrease in the alkyl chain of only one methylene group (e.g. γ-aminobutyrate, 3-aminopropanesulphonate or glycine) precludes binding. It appears, therefore, that by these criteria, the substrate range for this uptake system is relatively limited. As β-alanine is a competitive inhibitor of many taurine uptake systems [16–18, 21, 24, 28, 33], it has been suggested that taurine uptake occurs via the β-amino acid transport system defined by Christensen [34]. Our observations

Table 3. The effect of various drugs and other compounds on the uptake of [^{14}C]taurine by rat lung slices

Treatment	[^{14}C]Taurine uptake (% of control)
3-Isobutyl-1-methyl-xanthine (IBMX) (500 μM)	114 ± 7
Forskolin (100 μM)	102 ± 11
IBMX (500 μM) + Forskolin (100 μM)	89 ± 6
Diamide (10 mM)	11 ± 3*
Chloroquine (1 mM)	52 ± 6*
Chlorpromazine (250 μM)	31 ± 5*

Lung slices were incubated under the appropriate conditions in Krebs–Ringer phosphate medium containing 100 μM [^{14}C]taurine for 30 min at 37°. In the cases of diamide, forskolin and IBMX, the slices were preincubated for 15 min, prior to the addition of taurine. The accumulation of ^{14}C-label was measured by radiochemical techniques and adjusted for non-specific uptake occurring at 4°. The results are expressed as the mean ± SE with six animals for each observation. Control = 354 ± 19 nmol/g wet wt/hr.

* $P < 0.05$.

are not inconsistent with this possibility, especially since α-aminobutyrate, a model substrate for α-amino acid transport systems exhibits no inhibitory properties (Table 3). However, since γ-aminobutyrate is an inhibitor of both taurine and β-alanine uptake in various tissues [16–18, 21, 24, 25, 28, 35], but did not affect taurine uptake into lung slices, the transport of taurine into lung slices may occur through a system more specific than those responsible for general β-amino acid uptake.

Effect of various drugs and other compounds on taurine uptake

The pulmonary transport of [^{14}C]taurine appears independent of cyclic AMP, and presumably of agents using cyclic AMP as a second messenger, since 3-isobutyl-1-methyl-xanthine (an inhibitor of phosphodiesterase) and forskolin (a stimulator of adenylate cyclase) did not stimulate transport (Table 4), despite causing a significant increase in cyclic AMP levels. This is in contrast to taurine transport in kidney cortex [29].

[^{14}C]Taurine transport into the lung slice was greatly reduced by the glutathione oxidizing agent, diamide (10 mM) (Table 4), a finding consistent with that in kidney cortex [19]. However, although diamide treatment did result in a significant (50%) decrease in pulmonary non-protein sulphydryl levels, its effect in simultaneously depleting ATP levels to 3% of control may represent the mechanism of its action on taurine transport in the lung.

The antimalarial, chloroquine, and the phenothiazine derivative, chlorpromazine are both potent inhibitors of taurine uptake into lymphoblastoid cells and kidney cortex [2, 16, 24] and have been suggested to interfere with retinal taurine transport (since their prolonged administration results in retinal damage [2]). Although [^{14}C]taurine transport into lung slices was significantly reduced by both drugs (Table 3), the pulmonary accumulation of [^{14}C]putrescine was also significantly decreased (to 15 and 25% of control by chloroquine and chlorpromazine, respectively). Since both compounds are membrane active [36, 37], it is possible that these effects may be the result of non-specific alterations in membrane integrity rather than a direct effect on the transport system.

We have previously studied the accumulation and metabolism of the disulphide cystamine in the lung and identified this as a source of taurine [14, 15]. The plasma concentration of cystamine is thought to be very low (1 μM or less [38]). Nevertheless, at a concentration of 5 μM, it is accumulated by a high affinity transport system at a rate sufficient to contribute approximately 110 nmol/g wet wt/30 min of [^{14}C]taurine to the lung slice [14]. In the present study, we have shown that at a concentration of 100 μM, which approximates to its plasma concentration in the rat [8], [^{14}C]taurine is transported into the lung slice at a rate of about 150 nmol/g wet wt/30 min. Although direct accumulation may appear, therefore, to be the major source of taurine to the lung slice, it is known that the cystamine transport process is relatively cell specific, and is thought to reside only in the alveolar type I, type II and Clara cells [14]. It is likely, therefore, that the use of heterogeneous cell systems, such as the lung slice, results in an underestimation of the contribution of cystamine-derived taurine to the total taurine pool in these cell types. Consequently, we are currently working with isolated alveolar type II cells in culture to try and clarifiy this issue.

It should be noted that the amino acid, cysteine acts as a source of taurine in the liver [10, 39], and although its contribution to pulmonary taurine has not, to our knowledge been investigated, its role in this respect should be considered. Nevertheless, the apparent K_m of taurine for the transport system here described, relative to estimates of the plasma taurine concentration in the rat, implies that this system will contribute significantly to the pulmonary taurine pool *in vivo*.

The role of a taurine transport system in the lung is unclear. However, in addition to the rat, we have shown that mouse and hamster lung slices also accumulate [^{14}C]taurine (unpublished data), inferring a general requirement by the lung for such a system. It has been noted that tissues with a capacity to produce pro-oxidants (including the lung) have high concentrations of taurine [1–3]. Moreover, taurine itself has antioxidant properties [2–7], and in addition may act as an anti-inflammatory agent in so far as it will neutralize hypochlorous acid formed by various types of white blood cell [2]. It is possible, therefore, that the transport of taurine into the lung via the system here described may play an important role in the defence of the lung against oxidative damage.

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