true on a chlorophyll basis[13]. One can speculate that there may be a switch from the Calvin cycle in which ribulose diphosphate, is the acceptor of CO_2 to the HATCH and SLACK cycle in which P-enolpyruvate serves as the initial CO_2 acceptor. The latter cycle is found in more efficient photosynthetic plants such as *Zea mays, Saccharum officinarum* and other species in the tropical tribes of the Graminae. Accordingly, it was of interest to find that P-enolpyruvate carboxylase activity increased 3-4-fold in rust-infected leaves as compared to their healthy controls. Associated with this enzyme of the HATCH and SLACK cycle pathway is PEP-synthetase (not found in Calvin cycle photosynthetic plants) and while preliminary experiments indicated only a weak activity of this enzyme in rust-infected plants it was greater than that demonstrable in healthy plants. It will be necessary to devise a technique enabling one to separate the metabolism of green island tissue from that of the adjacent tissue and correct for the contribution of the parasite, before the question can be answered as to whether the HATCH and SLACK pathway is predominent in 'green island'[15,16].

Zusammenfassung. Nachweis, dass rostinfizierte Weizenblätter (*Puccinia graminis*) höhere PEP-Carboxylaseaktivität aufweisen als gesunde, und Feststellung einer PEP-Synthetase. Annahme, dass in den grünen Inseln der infizierten Blätter CO_2 nicht mehr nach dem Calvinzyklus, sondern auf dem HATCH und SLACK-Weg fixiert wird.

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Salivary Electrolytes, Protein and pH during Transcendental Meditation

The present investigation concerns the relationship of mineral metabolism with states of consciousness. Transcendental meditation, as taught by MAHARISHI MAHESH YOGI[1], is a world-wide practice of great uniformity and provides an ideal model for experimental study. WALLACE et al.[2,3] have shown that certain physiological and biochemical changes take place during the state of consciousness induced by the practice. Alterations in physiology include decreases in respiration, heart rate, O_2 consumption, CO_2 elimination with increased skin electrical resistance and EEG α-energies[2,3]. Also found were decreases in blood pH, base excess and lactic acid[3], suggesting a state of mild metabolic acidosis. In this study the effects of meditation on salivary minerals and pH was investigated as a preliminary to studies on blood chemistry during the practice.

Materials and methods. The subject, a male university student, had been practicing transcendental meditation for about 6 months and was investigated during 10 sessions over a 2-week-period. Meditation was performed in the late afternoon, after at least 6 h of fasting, in the subject's own home. Unstimulated, mixed saliva was collected by free flow immediately before, and immediately after, a 20-min meditation, and again 10 min after meditating.

The pH of the samples was measured with a Radiometer pH meter and cationic electrolytes were quantitated in 5% trichloroacetic acid (TCA) extracts by atomic absorption spectrophotometry. Inorganic phosphate[4] and protein[5] were measured by classical procedures. TCA-soluble protein was precipitated by shaking with diethyl ether and subsequent aspiration of the ether layer. For statistical evaluation the data was analysed by the paired *t*-test with pre-meditational values acting as control.

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Effects of meditation on salivary electrolytes, protein and pH

	During meditation	*P*	Before meditation (control)	*P*	After meditation
K (µg/ml)	1320 ± 44[a]	< 0.001	1070 ± 57	n.s.[b]	980 ± 35
Pi (µg/ml)	417 ± 16	< 0.001	286 ± 10	n.s.	269 ± 12
Na (µg/ml)	300 ± 13	< 0.001	176 ± 11	n.s.	200 ± 14
Ca (µg/ml)	118 ± 5.1	< 0.001	87 ± 1.6	n.s.	88 ± 4.2
Mg (µg/ml)	14.2 ± 0.9	< 0.001	10.1 ± 0.7	n.s.	9.6 ± 0.3
Zn (µg/ml)	9.8 ± 1.1	n.s.	8.8 ± 0.3	n.s.	10.2 ± 1.5
Acid-soluble protein[c] (mg/ml)	2.05 ± 0.10	< 0.001	1.06 ± 0.02	< 0.025	0.93 ± 0.05
Acid-insoluble protein[d] (mg/ml)	2.04 ± 0.12	< 0.005	1.50 ± 0.09	< 0.02	1.85 ± 0.11
Total protein[e] (mg/ml)	4.09		2.56		2.78
pH	6.54 ± 0.06	< 0.001	6.91 ± 0.04	< 0.02	7.01 ± 0.04

[a] Mean ± S.E.M. $N = 10$. [b] Not significant ($P > 0.05$) by paired *t*-test. [c] Protein not precipitated by 5% trichloroacetic acid. [d] Protein precipitated by 5% trichloroacetic acid. [e] Calculated (sum of values for acid soluble and insoluble protein).

Results and discussion. It was found that meditation produced a general increase in salivary minerals (Table) especially Na (70%), Mg (42%), Ca (36%) and P_i (46%). However K was increased a lesser amount (23%) and Zn was not significantly altered. 10 min after meditation there was no difference, from control period, in any of the electrolytes. The protein content of the saliva was also increased during meditation. TCA-soluble protein was elevated by 93% and TCA-insoluble protein by 36%, leading to an overall increase of 60% in total protein. 10 min after meditation the total protein content was still slightly elevated (+9%) due mainly to the 23% elevation in the TCA-insoluble fraction. However, the acid-soluble protein was significantly decreased (−12%) at this time. Salivary pH was decreased (0.4 pH unit) during meditation and slightly, but significantly increased (0.1 pH unit) 10 min after the practice. Values obtained for salivary pH and mineral content are in general agreement with published values[6].

The salivary changes during transcendental meditation indicate that extracellular fluid electrolytes may also be altered during this state. Some of the increase in solids is undoubtedly due to water reabsorption and/or the secretion of a more concentrated saliva. However, the large difference in the degree of concentration of solids (from +11% for Zn to +93% for TCA-soluble protein) indicates more than just an overall change in water concentration. Also, differential increase in acid-soluble over acid-insoluble protein, and the fact that the former is decreased 10 min after meditation, while the latter remains elevated, indicates a specific process involving these substances. Decreased salivary pH may reflect a slight acidosis as demonstrated by WALLACE et al.[3].

Studies are continuing on the biochemical correlates of transcendental meditation and the role of mineral nutrition in the mechanisms of consciousness.

Résumé. Lors de la pratique de la «méditation transcendantale» on a observé des modifications quantitatives du pH ainsi que des concentrations en électrolytes et protéines de la salive. Après 20 min de méditation on a trouvé des variations de certains minéraux salivères: Na (+70%), Mg (+42%), Ca (+36%) et phosphore minéral (+46%) alors que K et Zn n'ont augmenté que très peu. La concentration en protéines a augmenté et le pH a diminué pendant l'exercice. La composition de la salive est redevenue normale au bout de 10 min après la fin de la méditation.

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A Study of the Inhibition by Cysteamine on the Steroid 11 β-Hydroxylation

Recently, it was found that the adrenostatic effect of cysteamine on the corticosterone biosynthesis was caused by an inhibition of the 11β-hydroxylase system in the adrenal cortex[1–3]. With respect to this effect, cysteamine is comparable to metyrapone[4] and similar aromatic substances[5]. This conformity is surprising because cysteamine is aliphatic and has a free sulfhydryl (SH)-group with reducing properties. Therefore, one would assume that the mechanism of inhibition by cysteamine must be different from that by metyrapone.

As a first point of reference for the action mechanism, the inhibition of the steroid 11β-hydroxylase system by cysteamine was quantitatively compared with that caused by metyrapone. Further experiments were based on the fact that the metyrapone inhibition of the 11β-hydroxylase is specific, as the steroid C21 hydroxylase is unaffected[6,7]. Therefore, cysteamine and metyrapone were also compared with respect to their influence on the C21 hydroxylation. In a third series of experiments, cysteamine was compared with chemically related substances as to the effect on the 11β-hydroxylase.

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Table I. Steroid 11β-hydroxylase inhibition by cysteamine and metyrapone

Inhibitor	Enzyme activity	Concentration of inhibitor (*M*) Control	0.4×10^{-4}	1.0×10^{-4}	2.0×10^{-4}	4.0×10^{-4}
Metyrapone	absolute	28.61 ± 0.99	15.02 ± 0.7[c]	9.61 ± 0.63[b]	7.39 ± 0.44[b]	5.64 ± 0.2
	%	100	53	34	26	20
Cysteamine	absolute	28.61 ± 0.99	20.49 ± 0.62	13.80 ± 0.74	9.46 ± 0.67	6.23 ± 0.45
	%	100	73	44	33	22

Enzyme activity, calculated for n*M*/mg protein/h (absolute) and percent of control value. Adrenal homogenates, 4 incubations per dose. Mean ± S.D. *t*-test. All experimental values are significantly different from control values with $P < 0.001$. Significance of difference between metyrapone and cysteamine: [b] $P < 0.01$; [c] $P < 0.001$.