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# The Influence of Prosthetic and Operative Restorations on Bitter Taste-testing Ability.

By

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## Introduction.

The effect of prosthetic restorations and amalgam fillings on taste sensations has been widely discussed in odontological literature. Articles published during the time when physiologists believed that taste buds were evenly distributed throughout the mouth, suggest the theory that at any rate removable prosthetic restorations considerably lessen the ability to differentiate taste sensations. (LEOPOLD 1863, SEIFERT 1866.) Later, when it was proven that taste buds were located only on the surface and the borders of the tongue, on the soft palate, epiglottis, and even the larynx, with the anterior two-thirds of the tongue supplied with sensory fibres from the lingual nerve mainly sweet, salt, and sour and the posterior third from the glossopharyngeal nerve mainly bitter, the opinions were changed. Several authors including BROWN 1868, HERING 1866 and ACKERMANN 1887 deny every affect on the taste sensations since no taste buds are located within the region covered by the prosthesis. If patients in the beginning claimed their sense of taste to be affected, this would be due to the fact that they were not yet accustomed to the appliance, which would lessen their ability to differentiate taste. Improper cleansing might also affect the taste. SPRENG (17) in a survey, points out that removable prosthetic restorations, especially the upper denture, *infringe* upon the taste sense. However, he explains it chiefly as a psychological effect. Only remov-

able prosthetic restorations were discussed by the mentioned authors.

The problem became more complicated when different types of amalgam and alloys of precious and other metals were introduced to operative and prosthetic dentistry. Gold became discoloured in the mouth and the mucous membrane could be irritated locally as well as generally. Patients complained of metallic, salty or bitter tastes, SIKORA 1929, MASUR 1926, TREIBICH 1926, HAHN 1929 SAULSOHN 1931, and others explained these effects by the galvanic currents which arise due to the different degree of ionization of each metal. TREIBICH 1926 believes that the currents are of the magnitude that no transport of ions to the opposite pole can be expected, but others are of a contrary opinion. The electrical current not only directly affects the pain and taste receptors, but also indirectly by electrolysis of the saliva. Sour saliva should produce stronger current. Furthermore, the total metallic area is of decisive importance. LIPPMAN 1930 showed experimentally constant currents at 1/10 milliampere and potential differences up to 1/4 volt; the lower the pH of the solution, the stronger the current. Furthermore, the position of the metal in the electrolytic series and thereby the electrolytic pressure of solution showed to be of great importance. He found the current at the instant of circuit closure to be considerably stronger, in one case with a potential difference of 1.2 volt. By polarization the current rapidly decreased. He believed that in the oral cavity, the tongue decreased polarization, and therefore the current would be much stronger. SPRENG 1945 agrees with the above-mentioned viewpoints, and is of the opinion that pulpitis, mucous membrane irritations and necrosis, metallic taste, and burning of the tongue can be due to galvanic currents caused by inhomogeneous alloys or the presence of dissimilar metals within the oral cavity.

All authors, however, who have discussed the problem of taste being influenced by metals and alloys and removable prosthetic restorations in the mouth, have based their opinions exclusively on theory, laboratory experiments, or very often on the patients' subjective judgment. But in no cases have clinical experiments on taste-testing ability been made; therefore, for the analysis of this problem, their work must be considered of little importance.

No one of them, however, have made clinical experiments on taste-testing ability; therefore, for the analysis of this problem, their opinion must be considered of little importance.

## Literature.

The food-chemist LAIRD 1939 tests the ability of persons with prosthetic restorations to differentiate tastes. He experimented with pineapple juice, where the only taste sensation that changed in the various tests was along the scale sweet to sour. The variation in taste between each sample was of the same degree. A group of 25 women and 25 men, ranging from 50—68 years of age, from the middle and upper classes, were used as subjects for the tests, giving consideration to which taste each preferred. Hereby he concludes that they can differentiate tastes. A "two-sample test" was used, *i. e.* that only two different variations of taste with one sample of each were compared at the same occasion. Comparisons were made between five taste variations.

22 of the subjects had complete dentures. The author did not note the material of which the dentures were made, neither when nor how well they were last cleaned. Results, however, show an increasing partiality toward the more sour juices on the part of the men with complete dentures. While in the other group, women both with and without dentures preferred the same taste variety. Therefore, he also examined a group of women ranging from 20—40 years of age without prosthetic restorations, and it was found that they preferred the same as men without prosthetic restorations. He believes this to explain the problem why it looks as though prosthetic restorations could change the taste perception of male subjects. The "denture group" had reached a high physiological age with age affected taste buds, and according to the author, a person then prefers less sweet food. The denture in itself does not affect the sense of taste.

These conclusions appear bold since they are arrived at indirectly. His presentation of the material is incomplete with no figures given. The article is of interest, however, because a reliable method of testing was employed.

## Own Investigations.

a. *Presentation of problems.*

At Stockholm Breweries Ltd. and Carlsberg Breweries Ltd. in Copenhagen, a so-called taste test and chemical and physical tests are employed in order to give a continuous control of the

**Table 1.**

| Nr. | Age | Sex | Nr of tests made | | % correct | $\chi^2$ Indication of deviation |
|---|---|---|---|---|---|---|
| | | | total | correct | | |
| 1 | 25 | male | 16 | 12 | 75.00 | — |
| 2 | 27 | » | 3 | 3 | 100.00 | — |
| 3 | 28 | female | 10 | 7 | 70.00 | — |
| 4 | 28 | male | 14 | 8 | 57.14 | 0.00 |
| 5 | 29 | » | 25 | 6 | 24.00 | 10.79** |
| 6 | 30 | » | 15 | 8 | 53.33 | 0.06 |
| 7 | 30 | » | 22 | 12 | 54.55 | 0.04 |
| 8 | 30 | » | 14 | 9 | 64.29 | 0.34 |
| 9 | 31 | » | 34 | 18 | 52.94 | 0.18 |
| 10 | 33 | » | 45 | 23 | 51.11 | 0.54 |
| 11 | 33 | » | 15 | 11 | 73.33 | — |
| 12 | 34 | » | 60 | 30 | 50.00 | 1.05 |
| 13 | 35 | » | 17 | 5 | 29.41 | 5.11* |
| 14 | 37 | » | 61 | 38 | 62.30 | 0.82 |
| 15 | 38 | » | 15 | 12 | 80.00 | — |
| 16 | 38 | » | 30 | 21 | 70.00 | 2.20 |
| 17 | 38 | » | 56 | 28 | 50.00 | 0.98 |
| 18 | 39 | » | 74 | 47 | 63.51 | 1.46 |
| 19 | 39 | » | 40 | 21 | 52.50 | 0.27 |
| 20 | 39 | » | 58 | 39 | 67.24 | 2.70 |
| 21 | 39 | » | 57 | 23 | 40.35 | 6.10* |
| 22 | 39 | » | 32 | 14 | 43.75 | 2.14 |
| 23 | 40 | » | 16 | 6 | 37.50 | 2.37 |
| 24 | 41 | » | 83 | 53 | 63.86 | 1.80 |
| 25 | 41 | » | 86 | 51 | 59.30 | 0.26 |
| 26 | 41 | » | 96 | 70 | 72.92 | 10.45** |
| 27 | 42 | » | 83 | 48 | 57.83 | 0.06 |
| 28 | 42 | » | 67 | 50 | 74.63 | 8.89** |
| 29 | 42 | » | 36 | 16 | 44.44 | 2.15 |
| 30 | 43 | » | 53 | 16 | 30.19 | 15.01*** |
| 31 | 43 | » | 15 | 9 | 60.00 | 0.07 |
| 32 | 43 | » | 45 | 33 | 73.33 | 5.16* |
| 33 | 44 | » | 38 | 16 | 42.11 | 3.23 |
| 34 | 44 | » | 64 | 43 | 67.19 | 2.94 |
| 35 | 44 | » | 57 | 24 | 42.11 | 4.85* |
| 36 | 44 | » | 13 | 4 | 30.77 | — |
| 37 | 45 | » | 31 | 15 | 48.39 | 0.84 |
| 38 | 45 | » | 33 | 17 | 51.52 | 0.34 |
| 39 | 47 | » | 66 | 31 | 46.97 | 2.47 |
| 40 | 47 | » | 52 | 33 | 63.46 | 1.01 |
| 41 | 48 | » | 16 | 3 | 18.75 | — |
| 42 | 48 | » | 64 | 28 | 43.75 | 4.28* |
| 43 | 49 | » | 23 | 9 | 39.13 | 2.85 |
| 44 | 50 | » | 103 | 58 | 56.31 | 0.00 |
| 45 | 50 | » | 66 | 41 | 62.12 | 0.83 |

| Nr. | Age | Sex | Nr. of tests made | | % correct | $\chi^2$ Indication of deviation |
|---|---|---|---|---|---|---|
| | | | total | correct | | |
| 46 | 51 | male | 31 | 13 | 41.94 | 2.69 |
| 47 | 51 | » | 78 | 49 | 62.82 | 1.24 |
| 48 | 53 | » | 40 | 25 | 62.50 | 0.58 |
| 49 | 57 | » | 35 | 26 | 74.29 | 4.47* |
| 50 | 59 | » | 68 | 36 | 52.94 | 0.36 |
| 51 | 61 | » | 101 | 65 | 64.36 | 2.50 |
| 52 | 63 | » | 38 | 18 | 47.37 | 1.31 |
| 53 | 64 | » | 81 | 55 | 67.90 | 4.24* |
| 54 | 70 | » | 100 | 53 | 53.00 | 0.52 |
| Total nr. of taste-testers | | | 2,491 | 1,409 | 56.56 | |
| The mean of taste-tests | | | 46.13 | | | |

quality of their products. Experience shows that this taste test includes the essentials of most analytical methods, and is, if properly carried out, a far better indicator for the quality of the beer than other methods of analysis.

It has often been discussed whether or not prosthetic restorations affect the ability to differentiate taste sensations, especially the sense of bitter taste. It must be pointed out that all future references to taste, also imply the odour of beer, because the tests were made with no attempt to differentiate the taste and olfactory sensations. My main problem when I had the opportunity to investigate the taste tests at Stockholm Breweries Ltd. was to determine whether removable prosthetic restorations had any effect on the ability to differentiate bitter taste sensations. Since only three of the persons employed as tasters had removable dentures, and they had worn them the entire period of employment, the investigation did not provide material to answer this question. On the other hand, the results can be of interest in discussing the possible influences of galvanic currents in the mouth.

b. *Material.*

The subjects (see table 1) were 53 men and 1 woman, ranging from 25 to 70 years of age, who had been professional tasters during a period of 1—10 years, and who had thereby got their ability to differentiate bitter taste graduated. It is known that intelligence influences the efficiency of taste testing, and all persons used as subjects must be of such mentality that the intelligence will have no noteworthy effect. Furthermore, all persons who

were unsuccessful with the triangle test (see method) were eliminated; thus, the subjects had above average skill.

The tasters, who deviated from the mean within the selected group, either up or down, are marked with an asterisk. In regard to details in the statistical work and the classification of the subjects, I refer to BENGTSSON (1943, 1945). In this discussion, a significant deviation is indicated as follows: * $\geqq 0.95$, ** $\geqq 0.99$, and *** $\geqq 0.999$ ($2\sigma = 0.9645$, $3\sigma = 0.9973$). If too few taste tests were made, no deviation from the mean was calculated.

c. *Method.*

The tasting has in all cases been done by means of a selection or a triangle test, which implies that the subject receives 3 samples, 2 of which are identical. He is to determine which one differs. A successful differentiation is referred to as "correct" in the tables. Experience has shown that this method rapidly eliminates overconfidence of the subject and at the same time controls his ability to differentiate taste.

The tests were made in a special odourless room with constant room temperature, and distracting factors were eliminated as far as possible. Black drinking glasses were used if the samples differed in colour, and the glass was always tasteless. The intention with the test was indicated. Each taster worked independently of the others and written decisions were demanded.

d. *Factors influencing individual taste testing ability.*

A complete account of all factors that possibly affect the skilfulness of testing by taste would be too long. Here are mentioned only some of the interesting data which the brewery had on hand (BENGTSSON, KJ. 1948). It is to be expected that even slight infections and catarrhs in the oral and nasal cavities will rapidly decrease the capacity of reaction. More remarkable is the fact that age seems to have no decisive influence. Here a comparison with LAIRD's investigation regarding sweet-sour taste might be of interest, see preceding reference.

A study has also been made of the significance of smoking. Its influence seems to depend upon the individual's physiological condition, and does not follow any general rule. At any rate, it appeared that the subject should not smoke from 1—2 hours

before taste testing. — A systematic training is of importance, at least to acquire the ability to describe the taste sensation.

e. *Definition and groupings.*

Upon examination, the amalgam and metal surfaces have been recorded thus that occlusal and gingival fillings are counted as $^1/_3$ surface, a proximal surface or equivalent is counted as 1 surface, and a full crown as 5 surfaces. Large proximal fillings that extend over the lingual or buccal surface or both is counted as $1^1/_3$—2 according to size. The cast base for a Davies Crown is computed to $^1/_3$—$^2/_3$ surface according to thickness. A Richmond Crown has been estimated to 3 and a pontic to 2 surfaces. Silicates and porcelain inlays were recorded but not included in the calculations.

The lowest number of restored surfaces which occurred in a subject was 5, and the highest 83, with an average of 31 surfaces. As "few surfaces" have been included such as are less than $\frac{5 + 31}{2} = 18$, and as "many surfaces" those that are more than $\frac{31 + 83}{2} = 57$.

In mouths that had both gold and amalgam fillings, at least 5 and up to 66 amalgams were discovered, with an average of 18; and at least 1 and up to 75 gold surfaces, with an average of 17.8. As "many amalgam surfaces" relative to gold, have been included all that are more than $\frac{5 + 18}{2} = 11.5$ and as "many gold surfaces" relative to amalgam, all that are more than $\frac{17.8 + 1}{2} = 9.4$. Since both values lie so close to that of 2 full crowns or 10 surfaces, this number signifies the demarcation. Besides the amalgam and gold surfaces, any changes in the paradentium and mucous membrane of the tongue and mouth have also been recorded. The condition of the paradentium has been classified as either clinically healthy gingiva or paradentosis. The depth of sockets was routinely checked with the idea that pus and detritus could affect the bitter taste. This group also includes cases with different types of deposit on the teeth. The tongue condition was classified in two groups, one with marked hyperkeratosis or cleft tongue and one with normal tongue. Only 4 cases showed a complete change in the oral mucosa, and these all suffered from other

chronic illnesses (asthma, diabetes mellitus, ulcer, and pernicious anemia). Only 3 of the subjects had removable prosthetic restorations.

A survey of the grouping is given in table 2. Table 3 lists the subjects included in each group and the number of tests made, together with the number correct and the percent correct.

**Table 2.**

| | | | | |
|---|---|---|---|---|
| Group | I | Cases | with | few surfaces of the same filling material, amalgam or gold, healthy mucosa, healthy gingiva, and normal tongue. |
| » | II | » | » | few surfaces of the same filling material and normal tongue. |
| » | III | » | » | few surfaces of the same filling material. |
| » | IV | » | » | few surfaces of amalgam and gold or other alloy. |
| » | V | » | » | few surfaces, normal tongue. |
| » | IV | » | » | many surfaces of amalgam and gold or other alloy. |
| » | VII | » | » | many surfaces, paradentosis and tongue changes. |
| » | VIII | » | » | many surfaces and tongue changes. |
| » | IX | » | » | many amalgam surfaces, many gold surfaces, paradentosis, and tongue changes. |
| » | X | » | » | many amalgam surfaces, many gold surfaces, and tongue changes. |
| » | XI | » | » | many amalgam surfaces, many gold surfaces, and paradentosis. |
| » | XII | » | » | many amalgam- and many gold surfaces. |
| » | XIII | » | » | normal tongue. |
| » | XIV | » | » | very abnormal tongue. |
| » | XV | » | » | clinically normal gingiva. |
| » | XVI | » | » | paradentosis. |
| » | XVII | » | » | chronic illness. |
| » | XVIII | » | » | clinically healthy. |
| » | XIX | » | » | denture group. |

For detailed description, see text.

## Results and Discussion.

Due to limitations of the material, the statistical deductions are somewhat restricted. Some groups are rather small. Groups I and II are offset by subject No. 26, whose results clearly deviate upward from the average. In the other groups the extremely good and the extremely poor tasters counterbalance. The results of a comparison between the various groups by $\chi^2$-analysis are given in table 4.

The average percent correct for all tasters was 56.6 %. Groups I and II are *significantly above average.* The $\chi^2$-value for group I compared with the average percent is 5.260* and for group II, 6.361*. *Common characteristics for these two groups are "few surfaces" of the same filling material, amalgam or gold, and "normal*

**Table 3.**

| Taste-tester group | Group consists of taste-tester Nr. | Nr. of tests made | | % correct |
|---|---|---|---|---|
| | | total | correct | |
| I | 3, 7, 18, 19, 26, 47, 52 ..... | 358 | 224 | 62.6 |
| II | 3, 7, 14, 18, 19, 26, 47, 52 ..... | 419 | 262 | 62.5 |
| III | 3, 7, 11, 18, 19, 35, 47, 48, 52 ... | 374 | 214 | 57.2 |
| IV | 3, 7, 11, 14, 16, 18, 19, 26, 31, 35, 36, 39, 40, 45, 47, 48, 52 ..... | 773 | 461 | 59.6 |
| V | 3, 7, 14, 18, 19, 31, 36, 39, 47, 52 | 417 | 236 | 56.6 |
| VI | 2, 10, 12, 17, 25, 30, 43, 44, 50, 53 | 578 | 309 | 53.5 |
| VII | 17, 25, 30, 43, 50 ..... | 286 | 140 | 49.0 |
| VIII | 10, 12, 17, 25, 30, 43, 50 ..... | 391 | 193 | 49.4 |
| IX | 17, 25, 30, 33, 50 ..... | 301 | 147 | 48.8 |
| X | 10, 12, 17, 25, 30, 33, 50 ..... | 406 | 200 | 49.3 |
| XI | 15, 17, 25, 30, 33, 44, 50, 53 .... | 500 | 272 | 54.4 |
| XII | 6, 10, 12, 15, 17, 25, 27, 30, 33, 44, 50, 53 ..... | 703 | 381 | 54.2 |
| XIII | 2—7, 9, 13—15, 18—23, 27, 29, 31, 32, 36—40, 44, 46, 47, 49, 52—54 ..... | 1,333 | 745 | 55.9 |
| XIV | 11, 12, 16, 17, 25, 28, 30, 33, 34, 35, 42, 43, 45, 48 ..... | 719 | 393 | 54.7 |
| XV | 2—7, 9, 10, 12, 16, 18, 19, 21, 26—28, 34, 38, 41, 46, 52, 54. | 957 | 542 | 56.6 |
| XVI | 8, 11, 13—15, 17, 20, 25, 29, 30, 33, 36, 37, 39, 40, 42, 44, 45, 48—51 ..... | 1,088 | 603 | 55.4 |
| XVII | 25, 33, 48, 52 ..... | 202 | 110 | 54.5 |
| XVIII | 1—24, 26—32, 34—47, 49—51, 53, 54 ..... | 2,289 | 1,299 | 56.7 |
| XIX | 46, 49, 54 ..... | 166 | 92 | 55.4 |
| | Total Nr. of taste-testers | 2,491 | 1,409 | 56.6 |

**Table 4.**

| Comparison of taste tester groups | $\chi^2$ Indication of deviation of % correct |
|---|---|
| Comparison of group I with group VI shows ..... | 11.97*** |
| » » » I » » VII » ..... | 22.71*** |
| » » » I » » VIII » ..... | 24.68*** |
| » » » I » » IX » ..... | 23.82*** |
| » » » I » » X » ..... | 25.75*** |
| » » » I » » XI » ..... | 9.47** |
| » » » I » » XII » ..... | 10.13** |
| » » » II » » VI » ..... | 13.85*** |
| » » » II » » VII » ..... | 22.71*** |
| » » » II » » VIII » ..... | 28.35*** |
| » » » II » » IX » ..... | 23.82*** |
| » » » II » » X » ..... | 30.66*** |
| » » » II » » XI » ..... | 11.12*** |
| » » » II » » XII » ..... | 11.78*** |
| » » » III » » VI » ..... | 2.11 |
| » » » III » » VII » ..... | 8.23** |
| » » » III » » VIII » ..... | 9.00** |
| » » » III » » IX » ..... | 8.48** |

| Comparison of taste tester groups | | | | | | | | $\chi^2$ Indication of deviation of % correct |
|---|---|---|---|---|---|---|---|---|
| Comparison of | group | III | with | group | X | shows | ..... | 9.63** |
| » | » | III | » | » | XI | » | ..... | 1.30 |
| » | » | III | » | » | XII | » | ..... | 1.30 |
| » | » | IV | » | » | VI | » | ..... | 8.80** |
| » | » | IV | » | » | VII | » | ..... | 13.05*** |
| » | » | IV | » | » | VIII | » | ..... | 17.00*** |
| » | » | IV | » | » | IX | » | ..... | 14.11*** |
| » | » | IV | » | » | X | » | ..... | 18.05*** |
| » | » | IV | » | » | XI | » | ..... | 5.62* |
| » | » | IV | » | » | XII | » | ..... | 8.53** |
| » | » | V | » | » | VI | » | ..... | 1.63 |
| » | » | V | » | » | VII | » | ..... | 6.89** |
| » | » | V | » | » | VIII | » | ..... | 8.16** |
| » | » | V | » | » | IX | » | ..... | 7.15** |
| » | » | V | » | » | X | » | ..... | 9.02** |
| » | » | V | » | » | XI | » | ..... | 0.79 |
| » | » | V | » | » | XII | » | ..... | 0.96 |
| » | » | XIII | » | » | XIV | » | ..... | 0.46 |
| » | » | XV | » | » | XVI | » | ..... | 0.61 |
| » | » | XVII | » | » | XVIII | » | ..... | 0.51 |
| » | » | XIX | » | the total number of taste testers | | | | 0.10 |

*tongue*". Groups III and IV do not appreciatively deviate from the average percent.

Groups VII to X, inclusive, lie *significantly below the average percent.* $\chi^2$-values are: group VII, 6.772**, group VIII, 8.022**, group IX, 7.034** and group X, 8.869**. Significant for these groups are "*many surfaces*" and "*abnormal tongue*". In groups VII and VIII the restored surfaces are chiefly amalgam, with only occasionally one of gold. In groups IX and X, however, both metals occur with at least 10 surfaces of each.

As previously mentioned, the original problem concerned the influence of removable prosthetic restorations on bitter taste sensation. The denture group (XIX) consisted of 3 individuals, each with a different type of removable appliance; therefore, no conclusion can be drawn. — The analysis showed no difference between clinically healthy and chronically ailing persons (group XVIII and XVII), but this result is not statistically significant since group XVII consists of only 4 persons.

It was of interest to note whether the paradental changes, especially those caused by improper cleansing, affected the bitter taste sensation, but in comparison between groups XV and XVI did not reveal any statistically conclusive difference. The size of these groups and the number of tests made were sufficient to give a fairly accurate result.

Since it is an established viewpoint that bitter taste sensation is more developed at the back of the tongue, mainly within the papillae vallatae, it seems possible that hyperkeratosis of the tongue in this region would alter the quality of the taste purely by mechanical obstruction. Group XIII consists of subjects with clinically normal tongue, and group XIV includes those with marked hyperkeratosis. But the analysis shows no significant difference between these groups. The conclusion that it is impossible to judge the efficiency of a taste tester by observing the clinical appearance of the tongue, seems justifiable on the basis of the size of the groups and number of tests made.

In order to obtain evidence of the effect of the previously mentioned galvanic currents that are present in mouths with restorations of dissimilar metals, groups I to V, inclusive, have been compared with groups XI and XII. The result shows a significant difference in the ability of these two groups to distinguish the various bitter taste sensations. Group II, in all comparisons, shows a significant deviation of ***0.999. Groups I and IV also show significant deviations in all comparisons. Groups III and V as compared with groups XI and XII show no definite statistical difference, which is difficult to explain. It should be noted, however, that these groups all have normal tongues. It is possible that no galvanic current exists in such a mouth; an investigation of this has not yet been made. The importance of the metallic surface area needed to create a galvanic current has repeatedly been emphasized in literature. However, no statement has been made regarding the minimum of metallic area required to produce a current which is strong enough to conduct electricity. The data on groups IX to XII, inclusive, furnish sufficient evidence to conclude that 2 amalgam crowns and 2 gold crowns existing in the same mouth can produce a galvanic current, which will in time affect the individual's ability to differentiate bitter taste sensations. Inhomogeneous alloys play an important part in this connection. It is possible that still smaller areas may produce the current. This assumption is supported by the fact that groups VII and VIII (few gold, chiefly amalgam) were found to diverge significantly below the average percent "correct".

Upon detailed examination of the statistical results, it is noted that the greatest deviation occurs in groups I and II and groups VII to X, inclusive. Especially striking is the significance of group

X, consisting of many gold and amalgam surfaces and abnormal tongue condition. A possible explanation is that this tongue condition, at least partly, is dependent upon an existing galvanic current. If this current can cause superficial changes of the tongue mucosa, it seems probable that it could also affect the taste buds. A comparison between the groups with normal tongue and those with marked hyperkeratosis or other changes, revealed nothing of significance. However, in the first twelve groups the tongue abnormalities seem to play a certain rôle. Since the material does not include any group with few fillings and abnormal tongue or a sufficiently large group with many fillings and normal tongue, further particulars can not be discussed here.

## Summary.

The author describes an investigation of the oral conditions in 53 men and 1 woman employed as tasters of beer at Stockholm Breweries Ltd. In this investigation, which is the first of its kind, all restorations of amalgam, gold and other metals, as well as removable prosthetic restorations have been considered. The oral mucosa was also examined. The examined cases were then divided into groups according to their mouth conditions and their results as samplers were compared.

The tasting has in all cases been done by means of a triangel test. (Three dark drinking glasses containing the three samples two of which were identical.) Taste and olfactory sensations were not differentiated.

In 10 years, 2,491 taste-tests, were performed.

It seems statistically evident that the degree of bitter taste can be more accurately differentiated by persons with few dental restorations and healthy oral mucous membranes, than by persons with several restorations and abnormal oral mucosa, especially hyperkeratosis of the tongue. Particularly marked is the lowering of the taste differentiation where several gold and amalgam restorations are found in the same mouth.

The variations in the tongue conditions seemed to be of different origins. Thus, a statistically proven difference between a group with normal tongue and one with abnormal tongue conditions could not be established.

The effect of removable prosthetic restorations upon bitter

taste sensation could not be determined since the group was too small (3 cases).

As an explanation to the above data, the possibility of a harmful influence of galvanic currents upon the taste buds is discussed. These currents have not been measured nor have histo-pathological examinations been made. Another possible explanation is that individuals with many restorations could be of higher physiological age. The author, however, considers this less probable.

## Zusammenfassung.

Verf. beschreibt eine Untersuchung der Verhältnisse in der Mundhöhle bei 53 Männern und 1 Frau, die in der A/B Stockholms Bryggerier (Aktiengesellschaft Stockholmer Bierbrauereien) als Probierer von Bier angestellt waren. Bei dieser Untersuchung, die die erste ihrer Art ist, wurden sämtliche Füllungen aus Amalgam, Gold und anderen Metallen sowie auch abnehmbare Prothesen berücksichtigt. Auch die Mundschleimhaut wurde untersucht. Die untersuchten Fälle wurden darauf je nach dem Zustande ihrer Mundhöhle in Gruppen eingeteilt und ihre Ergebnisse als Probierer miteinander verglichen.

Die Geschmacksprobe wurde in sämtlichen Fällen in Form eines Dreiecktests vorgenommen (drei dunkle Trinkgläser enthielten die drei Proben, von denen zwei identisch waren). Geschmacks- und Geruchsempfindungen wurden nicht voneinander unterschieden.

Im Laufe von 10 Jahren wurden 2,491 Geschmacksproben vorgenommen.

Statistisch scheint dargelegt zu sein, dass die Stärke des bitteren Geschmacks von Menschen mit wenigen Füllungen und gesunder Mundschleimhaut exakter unterschieden werden kann, als von Personen mit mehreren Füllungen und veränderter Mundschleimhaut, ganz besonders mit Hyperkeratose der Zunge. Besonders ausgesprochen ist die Herabsetzung der Geschmacksunterscheidung, wenn in ein und demselben Munde mehrere Gold- und Amalgamfüllungen gefunden werden.

Die Unterschiede des Zustandes der Zunge schienen verschiedenen Ursprungs zu sein. So konnte zwischen einer Gruppe mit normaler Zunge und einer anderen mit verändertem Zustand der Zunge kein statistisch bewiesener Unterschied festgestellt werden.

Die Wirkung abnehmbarer Prothesen auf die bittere Geschmacksempfindung liess sich nicht feststellen, da die Gruppe allzu klein war (3 Fälle).

Als Erklärung der obenerwähnten Tatsachen wird die Möglichkeit eines schädlichen Einflusses galvanischer Ströme auf die Geschmacksknospen erörtert. Diese Ströme wurden nicht gemessen und histo-pathologische Untersuchungen nicht vorgenommen. Eine andere denkbare Erklärung ist, dass Personen mit vielen Füllungen vielleicht von höherem physiologischem Alter sind. Verf. hält dies jedoch für weniger wahrscheinlich.

## Résumé.

L'auteur apporte une étude de l'état buccal de 53 hommes et une femme employés comme dégustateurs de bière à la Société par Actions des Brasseries de Stockholm. Dans cette étude, la première en son genre, il a été tenu compte de toutes les réparations dentaires par amalgame, or ou autres métaux, ainsi que de la présence de prothèses amovibles. La muqueuse de la bouche a aussi été examinée. Les sujets étudiées ont été ensuite répartis en groupes selon l'état de leur bouche, et l'on a comparé les résultats qu'ils obtenaient dans leur travail d'essai.

L'épreuve de la dégustation a été faite dans tous les cas par un test triangulaire. (Trois verres à boire, de couleur foncée, contenant les trois échantillons, dont deux étaient identiques.) In ne s'est pas appliqué à différencier les sensations du goût de celles de l'odorat.

Au cours de 10 années on a pratiqué 2,491 tests du goût.

Il semble statistiquement évident que le degré d'intensité des sensations gustatives amères est distingué avec plus de précision par les personnes ayant de rares dents plombées ou aurifiées et une muqueuse buccale saine que par celles avec plusieurs dents refaites et une muqueuse anormale, surtout quand elles présentent aussi de l'hyperkératose linguale. Cette diminution de la faculté de discrimination gustative est particulièrement marquée là où coexistent dans la même bouche plusieurs aurifications et plusieurs réparations à l'amalgame.

Les variations dans l'état de la langue ont paru être de diverses origines. Cela n'a pas permis d'établir une différence prouvée statistiquement entre un groupe à langue saine et un autre où celle-ci offrait des anomalies.

L'effet des prothèses amovibles sur les sensations gustatives amères n'a pas pu être déterminé parce que le groupe considéré était trop petit (3 sujets).

Pour expliquer les constatations qui précèdent, l'auteur discute de la possibilité de l'action nocive de courants galvaniques sur les papilles du goût. Ces courants n'ont pas été mesurés, pas plus qu'on n'a fait d'examens histo-pathologiques des tissus. Une autre explication peut-être à retenir serait que les individus à nombreuses réfections dentaires pourraient être d'un âge physiologique plus avancé. L'auteur, cependant, considère cette hypothèse-là comme moins probable.

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