

*The Dangerousness of Mercury Vapor and of Amalgam Fillings*

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Two years ago I published a warning 1) that was based on my own experiences about the almost forgotten dangerousness of mercury, which in the form of amalgam fillings threatens a large group of people. My warning has found the desired resonance among doctors and dentists. That this resonance also sounded in the non-professional press was an unfortunate side effect.

The first response consisted, almost everywhere, of disbelief and rejection, which were voiced gruffly particularly by dentists. "The occurrence of mercury poisoning through amalgam fillings has never convincingly and without objection been ascertained" 2). The unanimously voiced decision of the annual meeting of the Central Association (Zentralverein) of German Dentists from 1926 called "the raised issues and attacks because of the use of amalgam as tooth filling material unfounded." By the measure that experiment and observation became the foundation of expression, the opinion changed. The quick enlightenment of professional circles can be attributed--next to the many individual investigations--particularly to the Mercury Investigative Agency of the First Medicinal Clinic of the Charite in Berlin founded by Privy Council His. At the Charite Prof. P. Fleischmann forcefully led the medicinal investigations of the issue. He worked hand-in-hand with Prof. P. Borinski, director of the Chemical Institute of the Berlin Health-Administration who had founded and lead the Mercury Investigative Agency of the City of Berlin. Yearly 16 of their agency-owned school dental clinics, together with 70 municipal dentists and nurses treating about 135,000 schoolchildren paid special attention to the damaging nature of amalgam.

Fleischmann (II, III) recently reported in detail about his observations. His writings readily clarify all the important connections. They prove that the warning was justified in all aspects and should signify the final turning point among medical and dental professionals judging the damaging quality of mercury and amalgam. So it seems the time has come to give an overview of the current state of this question whereby some conclusions may be drawn that can serve the health of the people. For two reasons I feel that I have the right to do this, although I am not a medical doctor. After my first publications I have received so many solid reports about mercury and amalgam damage that I can see myself as an expert. By the way, these observations are in agreement with Fleischmann's and only add to them. In addition I can lean on my own experience and that of my co-workers that have expanded recently to the field of amalgam fillings. Anyone who has experienced the insidious and depressing effect of mercury on himself, feels that it is not only his right but his holy human duty to help all those who are affected to be enlightened and restored.

This report mainly addresses three groups: Those who are threatened because of their profession, and doctors and dentists. Therefore this report also appears in three pertinent locations 3).

A. Mercury Vapor Poisoning  
1. Extent and Significance

According to the investigations by Fleischmann 4) no one can doubt the ubiquitous spread of chronic poisoning by mercury vapor among the professionally employed chemists, physicists,

physicians, dentists and school teachers teaching subjects in the natural sciences etc. Wherever mercury is used it is unavoidable, even with the greatest care, that liquid metal is occasionally being scattered; it divides itself as tiny dust everywhere and evaporates only slowly, taking months and years without being noticed. That is what the special dangerousness of this poison is based on.

It is surprising, as Fleischmann confirmed as well, how miniscule the quantities of mercury are that cause damage in humans with sufficiently long exposure. Fleischmann who justifiably believes that absorption during a state of constant, chronic poisoning is about the same as the elimination. He found among the "dental cases" ([i.e.] the given amount of mercury from amalgam fillings) 1/10,000 to 1/1,000 mg (1/10 – 4 gamma) mercury per liter urine, and in 100 "professional cases" he tested 1/10 gamma up to 100 mg mercury (only once 2.5 mg). The quantities excreted daily by the body he estimates to be 5 times those numbers. Thus it becomes understandable that constant presence in air, which contains per cubic meter only quantities of thousandths of milligrams of mercury, can lead to health disturbances 5). That is a tiny part of the amount (at room temperature 10 to 20 mg of mercury per cubic meter) that the air is capable of containing when it is saturated with mercury vapor. Until now it was thought that the minimum injurious amount was much larger. Only Teleky (4/100 – 1/10 mg mercury per day) came close to the truth. Other estimates (e.g. Joachimoglu 4/10 – 1 mg) reached much too high. Almost unfathomable is the number of things and apparatus' that contain mercury and are capable of causing mercury poisoning. In non-professional circles thermometers are to be looked at here. Mercury should be forbidden for room, window and bath thermometers etc.; after all there are other good liquids to fill them with. Sadly it is harder to replace fever thermometers, which often break, mostly in the bedroom. Formerly mercury barometers and amalgam mirrors would also have played a health-damaging role. Science uses mercury in ever-greater measure: As barrier fluid for gases since Cavendish' times 6), seals for ground glass, for electrical contacts, for manometers, sphygmomanometers, just to mention a few, where mercury surfaces come in direct contact with air. The nonchalance is astonishing with which this dangerous poison is handled, and the lack of conscience with which it is given into the hands of amateurs and even children (mercury condensers for radio-amateurs, mercury games of patience in which you could find several grams of mercury in a little cardboard box with a glass lid!). Even in medicine the necessary caution is not seen. For instance I found out about mercury poisonings which were caused by head eczema ointment used over several years that contained a large amount of mercury and through filling of a fistula with mercury for an x-ray.

Older chemical and physical laboratories, as the air analysis shows, are often contaminated with mercury. The experiences I had 1 and ½ years ago, after my move to the Technical University in Karlsruhe, were educational in view of this fact. At several workstations people complained about wellness issues that are characteristic for chronic mercury poisoning: unexplained fatigue, memory disturbances, drowsiness and headaches, irritability, mouth infections, diarrhea etc. It was like that--with only a few exceptions—in all of the rooms of the Chemical Institute, the Physical Institute, the machine laboratory in the Electro-Technical Institute, in the laboratory for lighting technique, and in the weather station. Everywhere the air contained mercury, the origin of which had not previously been recognized, and with its removal the symptoms disappeared. For example in one instance the origin of eyestrain during light measurements was investigated in a non-ventilated dark room. In fact a mercury jig (a paraffin block with open mercury receptacle) was at fault. An, at first, unexplained recurrence of my old mercury illness in connection with a bad headache was cleared up after the dust in the air and the cracks of the plank flooring of my Institute office where experiments had never been performed in the past were found to contain mercury. Luckily by analyzing the air 7), there is a sure method to find out whether the source of the symptoms can be found in mercury and whether the applied remedies are sufficient. In my case the seamless covering of the floor with linoleum succeeded.

Without doubt many suffer without knowing it from chronic mercury poisoning not only in manufacturing plants, where work is done with mercury, but also in scientific laboratories. Suspected Overwork “Semester Fatigue” etc. are certainly often nothing other than the first signs of poisoning. The elderly blame old age for them. Not Only Faraday and Pascal (compare X) must have been victims of mercury. Remarks relating to that are found in biographies of many known researchers who were, during their work, subjected to the influence of mercury, e.g. the characteristic temporary loss of memory (Berzelius, Liebig, Wohler). Heinrich Hertz, too, according to his frequently repeated 8) health complaints (tiredness listlessness, worsening of thinking and writing ability, tooth ulcers, chronic catarrhs, operations on the nose, “Rheumatic” symptoms) suffered most likely from mercury poisoning. Wilhelm Oswald recently wrote me that the severe illness he had to suffer through in 1895 9) with its almost exclusively psychosomatic symptoms, in retrospect, clearly seemed to indicate mercury poisoning. Here we are not talking about employees of the trade who suffered and still suffer because of mercury.

Every experimenter has to think about how dangerous mercury is, and that he has to handle it with much more care than occurred almost everywhere in the past decade. Earlier researchers, for instance Bunsen and Hempel, who worked a lot with mercury were more clued into that and insisted on strict and painstaking cautiousness while handling this volatile poison in their laboratories. Luckily in most laboratory rooms the mercury content in the air is usually so small that it is hardly dangerous, for instance, to the students, but threatens mostly those (assistants and docents) who work there for many years. The situation is different in rooms where care is lacking when it comes to mercury handling. I am mentioning a case from this Institute, to which I could add many similar ones, as a deterrent:

Dr. Z., a strong man in his early twenties, worked in a room at the Institute that formerly had served as a “Mercury Laboratory,” and in which, as it turned out later, much mercury had been scattered in the cracks of the floor and tables. The first symptoms showed up already after half a year and worsened extraordinarily in the second half of the year: Drowsiness, fatigue, moodiness, listlessness towards work, poor memory, lack of appetite, diarrhea, emaciation, bleeding gums, mouth ulcers, chronic nose and head colds, itchy skin etc. Everything improved fairly quickly after discovery of the cause and after the room was cleaned. Wherever such deplorable conditions exist, they have to be removed, both in science and industry. This is done in the interest of both the affected victim and the head of the laboratory. Work and its output suffer greatly from the intellectual and psychic effects of this slow poisoning by mercury. That there is much that needs improvement is shown in many letters I received. Here is an example from industry: Dr. W. worked in a room where mercury had been scattered. A great number of his co-workers suffered constantly from stomatitis. General fatigue, nervousness, and irritability were noticeable in all of them. However the bosses could not be convinced of the toxicity of mercury vapor.” Is the damage by small amounts of mercury, as is often assumed, tied to special and rare mercury hypersensitivity? Today the answer can only be: “No.” Fleischmann has observed in the comparatively small circle his came from, about 100 “occupational cases,” of damage by tiny amounts of mercury. I have found out about a multiple of that number. Whenever I had the opportunity to see the same mercury influence or found out about it in a larger group of persons (as in my own co-workers), it was always shown that all, or at least almost all afflicted, became ill--of course with individual differences in speed, strength, and appearance, as is a matter of course in the human organism. Others’ experiences are in agreement with this assessment, for instance the ones gained by medicinal council Dr. Gerbes and Professor Zangger in technical workshops who reported about them in the Berlin meeting of the Association for Internal Medicine on December 12, 1927 10). Mercury Hypersensitivity is not the exception, but the rule. Fleischmann is right with his supposition: “Certainly there is also an individual familial mercury-resistance, such as we know occurs with lead for example,” but those cases must be occurring more rarely.

## 2. Sign and Symptoms

In order to clearly determine early signs of mercury poisoning is not easy. Today we are, thanks to many observed “occupational cases,” well informed about its symptoms. This is particularly welcome in view of the assessment of damage through amalgam fillings. It was proven with certainty that the symptoms in specific cases really related to mercury because they disappeared after the elimination of the influence of mercury.

Generally the symptom complex in different patients is overall the same, even if, of course depending on personal genetic make-up, there are variations to be found, such as the absence of otherwise characteristic headaches or the appearance of diarrhea, which usually occur mostly later 11).

With these reservations the symptoms of (in a medicinal sense) mild mercury poisoning that is caused by constant intake of very tiny amounts of mercury can be classified in the following manner 12):

Stage 1: Fatigue, worsening ability “to get out of bed,” diminished desire and strength do mental work

Stage 2: Increased mental fatigue, inner restlessness, bad mood, irritability, diminished memory, and head-pressure.

Stage 3: Drowsiness, headache, restless sleep, lack of desire to live, shyness, salivation, chronic nose cold, head cold, throat infections, periodontitis, and infections of the oral mucosa, bleeding while brushing the teeth, formation of “pockets,” transient loosening of teeth, nervous restlessness of the heart, stomach complaints, lack of appetite, sudden diarrhea, slight intestinal bleeding and pain, and tremor.

Stage 4: Severe puss-producing head colds and throat infections 13), ulcers in the mouth and around the gums, loss of teeth, rheumatic tearing, skin rashes, severe diarrhea, vexing headaches, auditory disturbances, slight language and vision problems, severe depression, and loss of memory. At the same time, as a rule, appearance and body weight remain relatively the same.

The variable intermittent nature of symptoms is characteristic: in the beginning it varies between feeling well and not feeling well, later in the degree of the signs of the illness. Sometimes the worsening of symptoms sets in without discernable causality, almost suddenly. During recovery the symptoms disappear in the reverse order.

It is likely that the effects of insidious mercury poisoning are not confined to the ones listed. Fleischmann pointed to lymphocytosis as an accompanying sign. Whether and how much blood changes (i.e. leukemia, pernicious anemia 14)), diseases of the kidney and liver, sexual disturbances, and damage to off-spring (as in lead poisoning) are connected to the effects of mercury, has to be established by further research.

The first signs are of the purely nervous and psychosomatic variety, which may remain for a long time and could even be permanent as long as a sufficiently small amount of mercury is at work. His talked about the “Disassembly of Neuroses” because of the knowledge of insidious mercury poisoning. The peculiar failure of mercury is particularly significant, as Fleischmann often noticed as well (forgetting of otherwise familiar names, i.e. close acquaintances and numbers, i.e. of ones own phone number, not recognizing a person with whom one has talked very recently). In the beginning it is temporary, but may later increase and turn into an

inability to perform ones work (for which Fleischmann gives examples as well). Similar observations, by the way, are also made about insidious lead poisoning (compare P. Schmidt, VI and VII) and about Thallium poisoning, which has recently been occurring in industry. It seems to have the greatest resemblance to mercury poisoning.

Recognizing clinical mercury poisoning is particularly difficult as long as, in the beginning stages, it has not led to the bodily signs of oral infection, diarrhea etc. The first nervous complaints are of a totally ordinary kind, and may be caused by many other things. Often they are not even felt as “illnesses” by the patients themselves. Nevertheless they must of course be seen and valued as characteristic symptoms of mercury poisoning.

Sadly Fuehner (IV) errs when he says: “in urine testing we possess nowadays the best proof for objectively ascertaining mercury poisoning.” The analysis of urine, saliva and feces, as Fleischmann confirmed, show mercury for a long time, and in the same or greater quantities than may be seen in doubtlessly mercury-intoxicated patients, without the existence of any complaints. It takes very small quantities (15) of a continuous mercury load and a certain accumulation in the body (16) before the illness appears. In this regard, too, lead poisoning acts similarly (P. Schmidt III).

Nevertheless the most valuable diagnostic aid remains up to now the analysis of urine in feces (saliva is investigated less frequently) in so far as the lack of mercury in these excretions excludes mercury poisoning, and the conditions for poisoning are a given with a positive result. It must be noted that the mercury content in feces is usually generally higher than in urine, and that from day to day it is subject to great variations without any discernable reason. This was confirmed particularly by Borinski’s numerous analyses.

By the way, it should be pointed out that barely detectable traces of mercury in the order of magnitude of 1/100 gamma are often found in feces. It comes from food (compare section 6). The most dependable proof retroactively is delivered by recovery (17) after removal of all sources from which the body can take up mercury.

### 3. Healing and Protective Measures

Unfortunately no remedy is known, as yet, to detoxify the mercury found in the body or to get it to be excreted more quickly. So far there is no choice but to plug all sources from which even the tiniest quantities may access the body. Everything depends on it because it is certain, after much observation, that the person made ill by chronic mercury poisoning reacts especially sensitively vis-à-vis further addition of mercury. Wherever mercury-containing air is the cause of poisoning one must not rest until the mercury quantity in the air has been suppressed to a harmless level. It is almost always to be recommended to remove amalgam fillings. A dependable measure for the effectiveness of the measures taken is found in the final disappearance of mercury from excretions.

By the way, Fleischmann’s warning of “more caution during any work with mercury!” is to be stressed. That goes for the metal itself, and all mercury-filled breakable apparatus, be they fever thermometers or scientific instruments. As in earlier times mercury must again be treated as the, because of its volatility and its imperceptibility, particularly dangerous poison that it is. Unfortunately it is unthinkable to abandon its use in science and industry or even just as a teaching tool in schools. But nowhere must the cautionary measures be neglected. For instances, no mercury should be left uncovered; it should be heated only under a hood; while handling it bowls or something similar should be placed underneath; scattered mercury should be carefully removed; do not tolerate cracks and crevices in table surfaces; take care to provide ventilation in the work rooms. In this regard chemists and physicists are the worst sinners. In many chemical laboratories one gets the impression that one is downright proud of

the most evil “chemical” atmosphere. Opening of windows while working cannot be recommended enough; one gets used to the slightly lower temperature quickly.

The most reassuring control is once more the air analysis, which may be done so accurately with liquid air (XII). Unfortunately the simple color reaction with e.g. selenium sulfide (B. W. Nordlander V) that are recommended as proof of mercury in the air are not sensitive enough to find the smaller, but still damaging, amounts of mercury.

Wherever work with mercury is performed, it should occur in “Mercury Rooms.” In my laboratory we are still using extraordinary amounts of mercury in our “Vacuum-Apparatus” and gas analyses. With appropriate installations we have succeeded, nevertheless, that the air has become mercury-free. Electric ventilators air the rooms day and night. They are connected to work digestories (these are the rooms where the mercury is handled) to a large number of exhaust openings above and below, and to the cupboards used for storage of the apparatus (where you can always find traces of mercury). Fresh air streams in through large openings under the windows through dust filters and over radiators. The floor is covered with seamless linoleum that is pulled up 10 cm on the sides. The digestory slabs consisting of slate are surrounded by groves where scattered mercury collects. All solid furniture, tables, cupboards, etc. stand on high iron tube feet or on wall consoles or cement pedestals, on which the linoleum rises up 10 cm high as well so that there are no hard-to-reach and difficult-to-clean areas.

## B. The Amalgams

### 4. Endangerment of the Dentists

Two amalgam varieties are being used as tooth filling material: copper amalgam and noble [silver] amalgam. To make the former a ready-made purchased copper-mercury alloy (1/3 copper, 2/3 mercury) is heated until soft whereby mercury evaporates. In the second a solid alloy (mainly silver and tin) is stirred into mercury to form a malleable mass and the excess mercury is being squeezed out. During all these activities there is a chance that mercury enters the workroom, which almost always is also the treatment room in which the dentist spends time all day. Thus mercury is found almost without exception in the air of dentists’ workrooms and in their and their helpers’ excretions, and a great number of them and their co-workers suffer from chronic mercury poisoning.

Convincing Proof deliver the observations made by Fleischmann, and Borinski at the Berlin school dental clinics about 35 school dentists and 24 nurses who work there. Borinski found much mercury in the air of all clinics, in amounts of 3.3 gamma to 350 gamma (!) mercury per cubic meter. I have experienced similar things with private dentists, even where the room was laid out appropriately with, for instance, linoleum flooring. There copper amalgam had not even been used, and work was always performed with special care and cleanliness. Borinski, too, found mercury in the excretions of people employed at Berlin’s school dental clinics. In 80% of those people Fleischmann found a lymphocytosis of 30%, sometimes up to 50-60%. The [high] mercury content of urine in all dentists was pointed out already in older literature. I was able to confirm that fact myself several times. Luckily its content is rarely going to reach as high a level (above ¼ mg per liter) as it did in the case 19) that was recently described by Ahmed Hassan El Cheikh.

Fleischmann reports that among Berlin school dentists and school dental nurses, besides the two cases of advanced mercury poisoning, showing stomatitis and intestinal disturbances, stereotypical complaints of unusual tiredness and tendencies for headaches occurred repeatedly, and that nose/throat catarrhs were frequent problems. Describing a few characteristic cases of mercury vapor poisoning he writes: “I could lengthen the list and name

dentists' names in a number of similar cases." After a lecture I gave in Stuttgart about the subjects of mercury several dentists came to me whose symptoms left no doubt about strong mercury intoxication. To a degree the wives had to suffer, too, because the treatment room was used as a living room outside of working hours. Among older dentists the first symptoms of insidious mercury poisoning almost always show up when those involved are rarely aware of the cause, and are seeking it in the stresses of their profession. They can be healed. But until Fleischmann's demand is realized that, in the dentists' interest, all amalgams are to be replaced by other filling material, it is merely necessary to have greater insight and caution about the danger of handling mercury. Even the dentist himself who suffers from mercury poisoning might do well to possibly part from his own amalgam fillings. He has to get the point that all his mercury excretions must disappear if he wants to get well completely. For the dental treatment rooms, too, measures are appropriate as they are described in Section 3 about mercury rooms: "linoleum floor covering (no carpets!), ventilation 20) etc. Little can be gained by placing a few bowls with activated charcoal 21) or the use of zinc plates 22). But even though those types of devices are useful in taking up saturated mercury vapor and absorb it, they fail, as we have shown in our own tests with large sheets of zinc foil (compare X,) as soon as mercury occurs only in smaller quantities. The "guidelines" for working with mercury given in the school dental clinics of Berlin ought to be emulated. They, among other things, provide: preparation of amalgams only by specific personnel, and at a specific location, not touching amalgam with uncovered hands, fabrication of amalgam only in a mortar, storing amalgam waste under water, amalgam table with black seamless plates, electric ventilators in all work rooms, in each clinic special rooms so that doctors and nurses can take breaks and eat meals there.

## 5. The Damaging Nature of Amalgam Fillings

Contrary to the many passionately expressed doubts and objections, we have medical and dental observations in great numbers that prove that amalgam fillings are capable of causing chronic mercury poisoning. Fleischmann (II) thus described seven "complete cases" in which the removal of fillings complete lasting freedom from bad symptoms, which had led, in a few of them, to inability to perform gainful employment. There are more cases being watched. Corresponding published reports came from other sources as well. Concurring material flowed in my direction as well.

All in all the mercury amounts from amalgam fillings are likely to be smaller than those in workplace mercury poisonings. Fleischmann found in his clearly damaged patients 1/10 to 1/2 gamma mercury in a liter of urine. According to that number the signs are mostly confined to Stage I: Fatigue, weariness, listlessness, particularly when it concerns mental work, nervousness, irritability, forgetfulness, drowsiness, headaches, depression, bleeding of the gums while brushing the teeth, occasional diarrhea, chronic nose cold, catarrhs, and throat infections; as usual, everything takes place in intervals and in ups and downs of severity. Generally speaking, there is, in all regards, agreement about the effects of amalgam and mercury poisoning, for instance also that in some people the intestinal organs react first to mercury (Fleischmann, Case S., the above mentioned Case Dr. Z.). Fleischmann also stresses that, as of today, it remains unresolved whether more mercury vapor 23) coming from amalgams reaching the lungs, or mercury reaching the stomach, is the source of the damage. It is not at all known whether mercury changes chemically in the body and what the nature of this change is. Considering the great ability of this metal to resist chemical transformation, it is quite plausible that it remains in a free unbound state and thus disturbs the functioning of the organism 24). How much mercury amalgam gives off in the mouth, presuming constancy of the surface area, is influenced in several ways: It depends on the location of the fillings, on the use through chewing 25), possibly also on the consistency of the saliva; old fillings, as

long as they are not constantly being ground off by chewing off the surface, may lose mercury content over time, and so on.

We do not have to dwell much on copper amalgam fillings. Even though only 1 and ½ years ago they were still defended and even praised for their qualities to disinfect the mouth, they are nowadays pretty much dropped. The fact that they may cause severe health damage cannot be denied any longer, and my often the position that their introduction was a “Sin Against Mankind”, is proving to be well founded. Dentist Dr. J. Hochradel (26): “The Result as of now is that copper amalgam is out of the picture.” Fleischmann: “We have to do without the use of copper amalgam altogether for the dental practice.” Schoenbeck demands (IX): “that the copper amalgam as filling material has to go.” Dieck Write (I): “It should thus be justified, whenever the request is made, that from now on pure copper amalgam...is being eliminated from the list of filling materials.” Incredibly some people somewhere still try to keep “tin-copper amalgam” (a copper amalgam with 2-3% tin) although no reason can be discerned why such a small amount of tin should be changing the behavior of amalgam significantly. The judgment of the amalgam experts is therefore the following. E. J. Meyer (27) found that tin-copper amalgam, too, gave off mercury, at mouth temperature for weeks afterwards, and, at that, four times as much as noble amalgam. Wannemacher states (XIV, 153): “For copper amalgam with or without the addition of tin, cadmium or similar metals, the judgment should be almost unanimously negative. All experimental work shows that mercury is being given off of these amalgams in quite remarkable amounts.”

And Even Dieck, who belongs to the defenders of tin-copper amalgam, thinks (I, 835): “Thus, all in all, only the relatively cheaper price can be seen as an advantage for the preparation of copper amalgam with tin addition. Only those trains of thought, I have found out, make it plausible that the Berlin’s schools’ dental clinics, which until now have been using almost exclusively copper amalgam, have continued allowing the use of copper amalgam with tin addition, which they are now eliminating. That is incomprehensible considering the state of our current scientific knowledge.

There is not as much agreement about the noble amalgams as exists with the copper amalgams. The situation here today is as it was 1 and ½ years ago. Many still bristle at the ideas of its damaging qualities; the observations and facts noted in this regard are just now starting to take hold and effect. This is made worse because there is as yet no tooth filling material that can replace noble amalgam in all instances. With copper amalgam this difficulty does not exist: instead noble amalgam is used as of now, which although it is not without damaging qualities, it is at least less damaging than the former.

In other regards, too, things are less simple with noble amalgam. The number of materials contained in it, mercury, silver, tin, sometimes with small additions of gold and platinum added (it is then called “gold” and “platinum” amalgam) is bigger. The chemical and physical reactions that happen during hardening are more involved and less clearly discernible (28); they also depend on the accidental ratio of ingredients with which they happen because the solid alloy (the filings) is being mixed with mercury by the dentist himself, and it depends on the manner and care of working it. Further it depends on the age of the filings. The filings “age”, i.e. experience alterations that influence (29) their behavior towards mercury. In short, the amalgams that are finally found in the mouths are not anything clearly known, and change extraordinarily in consistency and durability (30). With this it is similar to the way it is with mayonnaise. One cook makes it well; another does it poorly (31)! As to the so-called gold and platinum amalgams with their minute amounts of their name-giving metals, Wannemacher’s statement (XIV, 154) is more likely to be right: “I do not give as much significance to the admixture of gold or platinum as is often given by some manufacturers.”

The fact that noble amalgams give off mercury as well, even though it is generally less than that coming from copper amalgam, is proven in, for instance, studies by E. J. Meyer 32), Ahmed Hassan el Cheikh 33), and W. Dieck 34). We, too, have found mercury in urine and feces of persons who had only noble amalgam fillings and had not totherwise come in contact with mercury. The fact that in bearers of noble amalgam fillings the test sometimes shows negative results, as Fleischmann observed, is easily explained. Whether provable quantities of mercury are being released from a filling depends to a high degree on the consistency of amalgam, the size of the filling, and its position in the mouth. Also mercury is often not analytically detectable any more, even though it may still exist in the feces. It can be concluded that, because of the marked fluctuations of mercury excretions, it may happen that no mercury is being found in individual analyses. Borinski, who observed 25 children with copper amalgam and 25 with noble amalgam, found mercury excretions in all 50, and he also noticed according to a privately conveyed message no significant difference between the two types of amalgam.

It has been determined that even noble amalgams have caused a significant amount of damage. Even though Fleischmann himself uses particular self-restraint in exactly these conclusions, it is still possible for us to use two of his seven “dental cases” as proof: Case Frl. Dr. M., who had, next to 15 noble amalgams, only one small copper amalgam and suffered from mercury poisoning, and Case Dr. M., in whom the symptoms and the mercury excretions had not stopped after replacement of the copper amalgams with those of noble amalgams, but whose symptoms completely disappeared after the noble amalgams were removed again.

I, too, have learned from dentists about quite a few cases, and I even was able to observe some myself, in which the signs of insidious mercury poisoning clearly disappeared. The patients completely lost the fatigue, vertigo, and headaches, which had previously bothered them, and felt—this expression was used repeatedly—“like newly reborn.”

In 1921 Prof. Dr. E. in Karlsruhe who was in his thirties and very healthy, allowed technically excellent noble amalgams to be laid, one big crown next to several smaller ones. He reported in 1927: For two years I have been suffering constantly from headaches and disagreeable bleeding of the gums, and, particularly while climbing stairs, a feeling of instability. As repeatedly noted by my physician, these symptoms could not be attributed to any organ-related findings and were initially diagnosed as neurasthenia 35). In November of 1926 I decided to have all amalgam fillings replaced by gold fillings. In spite of all precautions in the process of the removal of the fillings I experienced the symptoms described above at an increased rate. After that the overall well being, headaches etc. gradually improved, and, starting at about three months ago, I am feeling again pretty well. I have remained well until today.” In this case I was able to analyze the filling material: The main filling contained 37.6% mercury, 30.7% silver, 29.8 tin, 1.8% copper, 0.24% gold; it was thus made of pure noble amalgam.

Dr. Z., as already mentioned, had gotten mercury vapor poisoning in the spring of 1927 in the chemical laboratory and had pretty much recovered by the summer of 1927. Certain complaints, however, did not want to disappear: Tiredness, particularly upon rising in the morning, transient slight drowsiness, worsening of his ability to do mental work, and forgetfulness, especially of names, nervous irritability, slight bleeding while brushing the teeth, a tendency to have diarrhea, rheumatic pain, and itching of the skin. In December of 1927 two largish silver-white and perfect looking silver amalgam fillings that had been placed 1 and ½ years earlier were removed, but several insignificant looking fillings had been, until then, left in the mouth. First tiredness and all other signs increased for about four weeks. From then on there was gradual steady improvement. March 1928: All complaints are gone except for a few residuals, and constant bleeding of the gums while brushing the teeth. This, too, disappeared immediately after the last amalgam fillings were taken out.

As an addition to this case I can report about experiences concerning myself, which tell that under certain circumstances gold fillings have mercury, too, and are capable of causing damage. After the spring of 1924 the reason for my mysterious illness (see X) was found in mercury vapor. I had the last of my amalgam fillings--I had quite a few of them—replaced with silicone and gold, and the last complaints disappeared rather quickly. But even my body kept showing certain signs (drowsiness, fatigue, headaches, weakening of memory, diarrhea and bleeding gums) again and again without further improvement. The excretions kept containing mercury (about 1 gamma mercury daily in feces and urine). I could not explain those symptoms even though the analysis of the air in the rooms where I spent most of my time, and of the foods (compare Section 6) gave different provable mercury contents, but of such a small amount that the body could have received, at worst, 1/100 gamma mercury daily. The answer to the problem came by accident. A few months ago I had a gold filling weighing 1.0 g removed from a tooth from which a piece had splintered off, and it turned out that the filling, as I found out upon heating, distilled out containing 1.3mg mercury (36). Apparently it was this mercury that had caused the constant mercury excretions and complaints. These have gradually disappeared since the removal of the gold filling, and the gums, too, stopped bleeding and the bleeding did not return.

These conclusions generally demand caution in their acceptance. It is always possible to find similarities where someone has had amalgam and gold fillings next to one another [side-by-side]. You cannot yet unquestioningly depend on the fact that, with removal of all amalgam fillings, all mercury is gone from the mouth. You can be sure only when it has been proven analytically that the feces don't have any mercury left.

We have arrived at the important question of how common the damage from amalgam fillings is. Dieck says correctly (I, 839): The greatest weight has to be placed on the frequency with which a toxic effect occurs in the countless millions of cases of amalgam usage.

This is what presents itself:

1. A considerable number of cases have been determined in a few places. We are dealing here pretty much with more serious illnesses, which drove the patients to seek the help of a doctor.
2. As long as amalgams often give off mercury, they have to give off smaller amounts of mercury even more often. With every case of serious disease, as long as there is wide-spread mercury sensitivity, there have to be many more cases where the complaints are confined to the very first merely nervous and psychological signs of insidious mercury poisoning, failing memory, failing love of life and work, occasional drowsiness and headaches, which are not thought of as "illness" by those affected, but, instead, accepted as nervousness, over-work, and results of old age.
3. The observed cases originate from just a purely local small sample. They were not, somehow, given the observer in a systematic fashion, but so-to-speak, by accident. A resistance by most of the dentists fanned by wild propaganda, also in the daily press, stood in the way of an expansion of observation material. The dentists dissuaded the patients from removing suspected amalgam fillings, declaring that damage from amalgams is not possible. Also the resistance of most practicing physicians and dentists to put their experiences in writing or even in print, worked unfavorably.

The simplest statistical consideration leads to the conclusion that many, many people are likely to be damaged by amalgam fillings, at least many more than those dentists that are damaged by the preparation of amalgam fillings. As soon as the situation is known a little

better, people will be surprised about the extent of the damage mercury has caused here, too. Exactly because of the enormous distribution of amalgam fillings, amalgam, without doubt, has to be given the weight, which has, until now, been attributed to neuroses, neurasthenia, migraine etc. This is certainly true for many diseases of the gums and oral mucous membranes. The future will tell whether chronic mercury influence doesn't also cause other additional illnesses or at least heighten the receptivity for it. Certainly it increases susceptibility vis-à-vis additional mercury absorption. It is not unlikely that the reason for the "readiness for illness," which Professor Zanner, according to a private memo, saw among several workers of mercury-using manufacturing plants, is caused more by amalgam influence (or also by previous use of mercury containing medicines) than original individual predisposition.

It is hoped that Flesichmann's demands that "noble amalgams, too, are being replaced by other materials as soon as industry makes equally good material available" can be realized very soon. Whether this happens "more in the interest of the dentists" or their patients is unimportant. Both have to praise that moment!

Without doubt it is already an improvement that so far copper amalgam is disappearing as a filling material, even from the health insurance practice where it ruled a short time ago, and is being replaced by noble amalgam, provided that this is being applied according to the state of the art. With private patients, wherever possible, noble amalgam should be avoided as soon as possible, and filling material and cements or gold should be used instead. It cannot be foreseen how, sooner or later, an amalgam filling affects the person concerned. The worker who uses his mind in his work senses already the first nerve-related effects of insidious mercury poisoning as disturbing and more distressing than the worker who works with his hands. What's more he also works against those effects because he exercises his body more vigorously.

The difficulties, which are encountered in determining mercury vapor poisoning, reappear when judging whether, in an individual case, the complaints were a result of amalgam fillings. First of all, the proof has to be brought that the amalgam gives off mercury, and that it is contained in the excretions. The analysis of the feces should be given preference because of the earlier mentioned reasons. It should be noted that even people who do not have amalgam fillings, and do not come into contact with mercury otherwise, sometimes excrete traces of mercury (order of magnitude hundredth of gamma daily) in the feces, which they ingest with food (see Section 6). I have convinced myself about this several times. If the mercury excreting patient shows the known nervous and psychological complaints for which the physician cannot find another cause, removal of amalgam fillings is in order, and even more so when the pathognomonic first bodily signs are present: Bleeding of the gums, mouth infections, diarrhea, chronic catarrhs etc.

As a rule it is recommended to remove all amalgam fillings right away, at least the bigger, mechanically stressed ones. Whether the symptoms come from only one filling among several, can rarely be decided, also the sensitivity of a "mercury patient" is usually so great that traces of mercury can do damage to them that do not hurt others. Above attention was directed towards the possibility that gold fillings, gold crowns etc., which are located in the mouth together next to amalgam may take up mercury and later let go of it. If necessary, suspicious gold pieces 37) have to be renewed. The treating physician is advised to check the success of his treatment with subsequent mercury analyses. Only when mercury is not excreted any longer can one count on complete recovery.

The drilling out of the amalgam has to be done with utmost care so that the patient does not get larger amounts of mercury into the lungs or the stomach and because of this does not experience stronger symptoms. Seldom can this be completely avoided. The following is

recommended: Suctioning the dust that is created while drilling wherever the equipment for this is available; constant moisturizing of the filling and the instrument; the filling must not be allowed to get too warm for the mercury to evaporate.

## 6. Conclusions and Demands

The mercury and amalgam subject deserves the fullest involvement by all professionals. To brush it aside by comparing it [to cars and accidents] as is stated in the following sentence “Should the use of automobiles as a means of transportation be questioned with so few accidents...” 38), is an untenable point of view. The agencies in question have to devote the same attention to the subject of mercury as they do to the subject of lead. As opposed to lead, mercury doesn’t threaten just certain professions, but the widest circles of the population, because of its volatility and its ubiquitousness in amalgam.

One of the most important demands is the manufacture of a non-poisonous tooth filling material that pretty much equals amalgam in simplicity of application and durability, and also in price. Here the potential for winning is a possibility. We are not served by the distribution of purported mercury-binding toothpaste. Also Schoenbeck’s efforts to start with a mercury-rich solid filling amalgam, instead of liquid mercury, can, up to now, be seen only as a temporary interim solution. It would be desirable to have a metal alloy free of mercury and other harmful materials capable of transient warming so that it is soft enough to work with but still bearable in the mouth environment. It is necessary to establish a sufficient number of locations, for instance big hospitals, where the accurate analyses necessary for diagnosis and treatment of mercury poisoning can be performed without the costs being too high. The analyses require a certain amount of training and painstaking care, but dependable male and female chemical assistants can perform this work under supervision; expensive equipment is not necessary for this.

In order to get a deeper insight into the complexity and extent of mercury damage, it is necessary to establish a clearing-house where physicians and dentists would have to send pertinent reports. Perhaps the Quecksilberstelle (Mercury Place) at the Berlin Charite can be preserved after it has fulfilled its first purpose of researching the subject and giving it a department-oriented scientific foundation. As to the required training of practicing physicians, the most recent publication will do give all the necessary information. . But the enlightenment of lay people should not be neglected, either. The many people who do not see milder complaints stemming from amalgam as an “illness” and do not go to the doctor, but bear them as something unchangeable, dependent on predisposition, age or overwork, have to be educated that they can be helped –mostly in simple ways, that they can return to the enjoyment of their productivity and their existence.

It must be required that the daily press 40) stop with its appeasement propaganda that is supposed to “quiet down” the public at large. It does not correspond to the current state of scientific knowledge any more. The dentist should not deflect the wishes of a patient who wants non-amalgam fillings or who wants to have amalgam fillings removed. The patient, in that event, is perhaps more enlightened than the “professional” 41). The scientific reporting system should now refrain from propaganda 42), too. Anyone who still defends 43) copper amalgam today is slapping scientific progress in the face.

Further important questions are waiting for research in the field of mercury toxicity. I am naming only a few: Speeding up of demercurization of the organism, detoxification of mercury contained in the body, mercury content of the blood, amassing of mercury at specific locations in the body (mercury depots), the connection between “mobilization” of mercury and symptoms. Those are all subjects that can be dealt with much easier today because of the much more sensitive determination of mercury through analysis. There are interrelationships

between poisonings and other illnesses. There is a particular resistance and susceptibility. There is the influence of earlier damage by mercury, the detrimental quality of the constant influence of volatile mercury compounds, such as sublimate ( $\text{HgCl}_2$ ) that is being used to a large extent for the protection of wood against rot (Kyanization) for instance in the fight against "house fungus" 44). A matter, which also deserves attention, is the mercury content of our food (flour, bread), which apparently is caused by the rapidly spreading practice of coating (staining) seed grain with mercury containing chemicals.