The purpose of this paper is to give an introduction into the scientific sessions which deal with measuring and screening. Without doubt the analytical developments during the last years in this field exercised a great influence on legislation and jurisdiction in Germany as in other parts of the world. When we outlined the paper we intended to share the time and to report on analytical developments in measuring alcohol in the first chapter and on recent advances in measuring and screening of drugs in the second. But just at the moment there is no analytical problem which is more discussed in the general public of Germany than breath alcohol measuring. The discussion is controversial and not seldom the promoters of an evidential breath test refer to experiences from abroad. As many papers will be presented during this conference which deal with the problem of blood or breath, it is not unlikely that our general public will watch our discussions with fierce attention. That is why we decided to modify our prepared paper and to put only one topic in the foreground, the question of blood or breath. In our opinion it is necessary to give an introduction into the specific German problems. They are different from other countries and the scientific discussion should respect these differences.

Many of our guests from abroad might be astonished that this topic is under discussion in Germany even at this time. In our opinion there are many reasons for this peculiarity. But the main reason is the historic background. Research in this field from the beginning exclusively was concentrated on blood alcohol measuring, with Widmark's method and its modifications and, later on, the enzymatic method of Bonnichsen and Theorell. During the third and fourth decade of the century these methods were introduced in all German institutes of forensic medicine. The significance of alcohol findings in blood samples of drivers in cases of suspected DWI increased. But as no per se legislation existed the BAC was only one argument for the proof of drunken driving.

In 1955 the Bundesgesundheitsamt (BGA), the Federal Health Board, published an official statement summarizing the up to then analytical developments, epidemiological data and scientific findings concerning the relation between BAC and driving impairment. Respecting the analytical precision of that time it was recommended to introduce 1.5 Promille as the limit for a per se legislation. But it did not pass into law. Instead of, the Bundesgerichtshof (BGH), the Federal Supreme Court, changed its jurisdiction. Since this time, curious enough, the German jurisdiction differentiated between "absolute" and "relative" driving impairment. A BAC above 1.5 Promille carries sufficiently evidential weight to prove impairment by itself. BACs below 1.5 Promille as before must be supported by other evidence.

The analytical developments of the following years induced the ministers of justice and of traffic to ask the BGA in 1960 to revise the 1955 opinion. It took 5
years to provide the necessary scientific basis for a substantiated opinion. As many institutes of forensic medicine cooperated during these years blood alcohol research was forwarded considerably. Among others this resulted in the creation of a new journal "Blood Alcohol" in 1964 which became an official journal of our International Committee on Alcohol Drugs and Traffic Safety. The BGA opinion was published in 1966. It was recommended to reduce the limit of driving impairment to 1.3 Promille on the assumption that several exactly defined laboratory procedures were observed. Among others 5 single measurements, 3 by Widmark's method and 2 by the enzymatic method became necessary for the calculation of a qualified mean value within defined limits of confidence. This recommendation was adopted immediately by the jurisdiction of the Federal Supreme Court, BGH. A second recommendation of this opinion was to introduce besides the existing law a per se legislation for an abstract jeopardy delict with .8 Promille as the limit. This law became valid in 1973.

The 1966 opinion of the Federal Health Board was once more revised in 1977 when the gaschromatographic method introduced by Machata was declared to be equivalent to the pre-existing methods. A combination of 2 ADH and 2 GC measurements became the favoured procedure in nearly all German laboratories at least those of the institutes of forensic medicine.

With the increasing precision of the analytical devices the Federal Health Board recommended in 1989 to reduce the limit of the "absolute" driving disability to 1.1 Promille. This was adopted by the Federal Supreme Court in 1990. From the same reason, the improvement of our analytical devices, the German Society of Forensic Medicine recommended in 1991 to reduce the .8 Promille limit of the per se law to .5 Promille. Courts, including the Federal Supreme Court, sometimes work very fast. But legislation needs more time. However, we hope, that our recommendation will be followed within a short time.

As one can see the newest developments in measuring at any time had a concrete influence on legislation and jurisdiction. There is a clear tendency towards lower blood alcohol limits and, hopefully, this process will continue. But it should be emphasized that all research work forming the basis of our present legislation and jurisdiction was done on blood alcohol analyses. It took nearly 40 years to develop highly specific and precise methods of measurement, to get a sufficient insight into the pharmacokinetics of ethanol which is necessary especially for recalculations and to find safe relations between blood alcohol values and driving performance. Nearly all, if not completely all doubts are eliminated, and no problem seems to be left which was not already object of legal decisions. One may think that we should be satisfied with the present situation. But, crazy enough, the recent discussion in the general public about the introduction of an evidential breath test possibly will rock the boat.

Once more analytical advances are responsible for this development. Since Harger's Drunkometer from 1931 many technical subtle devices were introduced. A first climax was reached with Bob Borkenstein's Breathalyzer from 1957. Especially in the seventies and eighties more specific devices were engineered. Most of them use the infrared-method. There is no doubt that modern
devices have a high degree of accuracy, but it is not only the accuracy of the analysis which contributes to an evidential breath alcohol measurement. Physiological peculiarities such as sample volume and flow were usually controlled but also the breath temperature must be measured and used for correction as Schoknecht remarked in a recent opinion of the Federal Health Board. Such devices to our knowledge did not pass the experimental stage in Germany, which means that until today qualified scientific experiments on a broader basis are lacking. Even if such devices are available in 1 or 2 years looking back at 40 years of blood alcohol research it is obvious that the necessary background for the evaluation of breath alcohol values can not be provided within a shorter period.

One may ask, whether this is necessary. A way out of the difficulty might be to use breath alcohol values themselves instead of indirect blood alcohol concentrations calculated from the breath results. Necessarily new limits must be created for legislation as well as jurisdiction. But as the scientific basis for such definitions cannot be the results of blood alcohol research and a specific breath alcohol research at least in Germany is completely lacking only rough estimates derived from blood alcohol limits can be made. Recent proposals fixed the limit for the per se legislation at .4 mg/l. In comparison to .8 Promille blood alcohol this is a benefit for delinquents being in the elimination phase. But at the same time it is a disadvantage for all those being in the absorption phase. One might ignore this disadvantage or even welcome it because the impairment of performance during this phase exceeds that of the elimination phase. But this implies that breath values completely replace blood values. It is not likely that this will occur.

To stress only a few arguments: Supposed delinquents cannot be forced physically to breathe actively into a breath test device. There are two possible consequences: either a conventional blood sample will be taken which means that blood and breath values will coexist in the future or the mere refusal of the breath test becomes punishable. Whether the latter is conform with the German constitution is unclear. There are decisions of our Higher Courts which allow the suspect to refuse his active contribution to his own conviction. Moreover, doubtless there are persons who are unable to perform a qualified breath test because of disease or because of trauma and so on. At least in these cases blood sampling can be the only possible method to get reliable alcohol values. That is why in our opinion, if breath values were introduced at all, they will coexist with blood values.

This coexistence will be problematic. Separate breath values are only necessary if one respects that they cannot be truly converted to indirect blood values. If it were such they must not be introduced. As a limit of .4 mg/l breath in comparison to .8 Promille BAC is a benefit for delinquents being in the elimination phase, this means at the same time, that blood values as the alternative for all those who refuse are disadvantageous. One might accept this, but blood values under such circumstances are also disadvantageous for all those who are physically unable to perform a breath test, and that is not acceptable.

As another intricate problem the retrograde extrapolation should be mentioned. One of the advantages of the breath test as maintained by its promoters is that
breath tests can be performed at the scene of an accident or immediately thereafter. This assumption gave the idea that breath test results must not be corrected on the time of the accident. This might be true in several cases, but it is not true for hit-and-run drivers. As before a recalculation will be necessary and this can only be based on an expert opinion. But how recalculate breath values? As already mentioned the German alcohol research until today is fixed on blood samples. There is no sufficient knowledge about the postabsorbtional decrease of breath alcohol values. Of course, it is known that the breath curve does not parallel the blood curve during all stages. Such it is not possible to convert a breath value to a blood value, to recalculate the blood concentration and once more to reconvert the result to a qualified breath value. In addition such a procedure is in contradiction to the principle of inconvertibility of these values; otherwise it is unnecessary to introduce separate breath values, as mentioned before.

Another quite difficult problem concerns the quality control. For the analysis of blood samples the following procedure is prescribed: the sample must be analyzed with two different methods and at last two single measurements each. The resulting four or five single values must lie within defined limits of confidence before a qualified mean value can be calculated. These limits of confidence or, vice versa, the permissible error was respected when the official limits for absolute driving inability and for the per se legislation were defined. If the four or five single values exceed the limits of confidence, the measurements must be repeated. There are cases, indeed, where the sample volume is too small and allows only 2 or 3 measurements. In such a case the Bavarian Highest Court gave a quite interesting ruling. It was decided that 2 measurements resulting in values above 1 Promille give no reliable evidence for a blood alcohol concentration above .8 Promille.

Let us compare with the breath test procedure. It is proposed to perform only 2 breath tests within a maximum of 5 minutes. This means that the mean value can only be calculated out of 2 single values. Obviously the statistical confidence can not be the same as with four or five single values. As another statistically delicate problem these 2 single values are not derived from the same sample but from 2 different samples although we all know that there must be a primary difference from pharmacokinetical reasons. The introduction of an evidental breath test from this point of view such means a step backward concerning the precision of alcohol measurements. Whether this will be accepted by the courts is at least questionable.

There is another dubious procedure. Our blood alcohol laboratories undergo a strict control as well internally as externally. Within a series of blood samples control samples must be placed. Their results are not allowed to exceed defined limits. All documented results including the original curves must be stored and, if wanted, presented to the court. Twice a year the laboratory must participate in an external quality control, the result of which must be mentioned in the written reports. Such controls are not designed for breath alcohol devices. Instead of, only a calibration of the apparatus and recalibrations within certain periods are intended. This is a clear disadvantage in comparison to the conventional procedure.
To stress some more disadvantages: Blood samples must be stored for a longer period. This allows a second analysis at any time, and it allows serological analyses in cases of questionable identity. Nothing comparable can be offered by the breath test. Moreover, supplementary chemical toxicological analyses are impossible. In such cases, as before, blood sampling is the only method of significance. I am quite sure, that the authorities will not abandon blood samples in cases of suspected driving under the influence of drugs. But is driving under the influence of drugs more serious than driving under the influence of alcohol?

As one can see we are dealing with an intricate matter. We are sure that some more arguments for and against the replacement of blood by breath will be discussed during our conference. Especially the German participants are eager to be confronted with experiences from abroad.