A SELECTED CONSIDERATIONS ON SENSORIAL EVALUATION AND INSTRUMENTAL SYSTEMS FOR THE ANALYSIS AND QUALITY CONTROL OF MEAT AND MEAT PRODUCTS AND ON ADDITIVES IN USE BY THE MEAT INDUSTRY

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These introduction for the scientific session No.8 reviews some of the general aspe cts of the sensory /organoleptic/ evaluation of food and particularly of meat and processed meat products with the main consideration being given to its flavour and texture.

A selected problems regarding organoleptic analysis and of training requirements and procedures for the organoleptic panelist members are also considered. The instrumental systems for controlling the quality of meat and meat products and the contem porary developments related to the determination of their constituents are briefly presented.A very brief considerations regarding the additives in use by the meat industry are also provided.

Allow me please to commence my introduction to the present, and at that same time known and recognized scientist in among other fields and subjects also in organole ptics, Prof. Dr.D.J.TILGNER, professor emeritus of the Politechnical Unterestry of ptics, Prof.Dr.D.J.TILGNER, professor emeritus of the Politechnical University of Gdańsk, whose 80 years birthday we have had celebrated in Poland in 1985. During the opening lecture entitled."Elevent doction colord in 1985.

During the opening lecture entitled: "Flavour indetity and stability dillema" pre" sented for the audience of the International Symposium on "Flavour research - indi-cepts and methods", held in September 16-19,1981 in Rydzyna, Poland, Prof. Tilgner

"Food has always played an immensely important role in all kinds of human cele-brations.It is the oldest culture of man and both gastrology/the art and science eating/, and gastronomy /the art and science of cooking/ represent the cultural pumar ttern and civilization of the respective society a close relationship between tro-ideals and motivation, human development and behaviour.The becomputed of the gastry ideals and motivation, human development and behaviour. The bacground of the gastro-nomical culture is associated with the drive for perfection, developing the creative enthusiasm of individuals with their efficient activity, health, vigour, energy, sense of duty and responsibility. The creative will of the individual and the continuous drive for the new and better and ever higher form of evaluation has many examples in contemporary achievements of human creativity, to name just few like vitaminology, gy, enzymology, electronics, cosmic exploration and, last but not least, flavourology which is not just another whimsical thread of the ivory tower research in a world stagnant malnutrition and with a great overpopulation, but a natural tendency to ideals and motivation, human development and behaviour. The bacground of the gastry nomical culture is associated with the drive for perfective bacground of the greativ stagnant malnutrition and with a great overpopulation, but a natural tendency to the tendency to the stagnant will, that is a truly humanistic principle

creative will, that is a truly humanistic principle. - In the continuous progress for perfecting the world, foods plays a basic role We should remember that each civilized man sits down some 70000 times at the just the should remember that each civilized man sits down some 70000 times at the just the should remember that each civilized man sits down some 70000 times at the just the should remember that each civilized man sits down some 70000 times at the just - just and either enjoys his food with aesthetic and sensory introspective delight of that food that the sensory introspective delight of that food that the sensory introspective delight of that food that the sensory introspective delight of that food the sensory is the sensory introspective delight of the sensory is the sensory introspective delight of the sensory is the sensory introspective delight of the sensory is refuels his bodily frame in a prosaic way. It has to emphasized again and again t food cannot be assayed only or mainly from the nutritive point of view. Food must give satisfaction and entowment It to recent the nutritive point of view. Food must give satisfaction and enjoyment. It is regrettable that not only consumers, but also

This voluminous texbook is an excellent manual covering sistemation, and application of sensory analysis./60,135/. In a sensory analysis many different scaling and descriptive tests exists.A secriminative test such as triangular test may be used and is very suitable if the purpose is to estimate whether a difference exist on overall quality or e.g.in were the chance probability from 0.33 to 0.11 consist of 2 triangular tests carried to the chance probability from 0.33 to 0.11 consist of 2 triangular tests carried to the same samples by the same panelists, only counting the number of panelis-to get a correct decission P 5%/.Other discriminative tests like rating difference the difference is. Method using category scales are most frequently used.The criterias most often

researches and food practitioners, who wish to acquire a higher degree of personal Sensory efficiency and effectiveness. There is no equal to it in any other language and application of personal values (60.135/. language.

In the USA outlines were recently been developed of sensory,physical and chemi-properties considered of importance in the evaluation of the six product types Cal properties considered of importance in the evaluation of the six product types namely: ground beef and fabricated products, fresh sausage, frankfurters and bologna, ducts, which are covering such main organoleptic features like: flavour, aroma, appe-rance, which are covering such main organoleptic features like: flavour, aroma, appe-livided for numerous descriptive, sensorial characteristics such as: rancid, putrid, ness, firmness, densiness, chewiness and the like /19,21/. Also recently was published a manual, partly bilingual, by G.Jellinek: "Sensoris-book for the practice/, on which, among other comments, Prof.Tilgner wrote:"This well researches and food practitioners, who wish to acquire a higher degree of personal sensories and food practitioners, who wish to acquire a higher degree of personal Cal

For the training purposes and for unification of the data of organoleptic analysis and in order to make possible a comparisons between findings presented in lite-<sup>315</sup> and in order to make possible a comparisons between findings presented in inte-rature sources, attempt were and are in progress aiming at elaboration of the res-pactive guidelines, manuals, instructions, outlines, monographs and papers, many of whi-ch include chapters on training of panelist members./3,4,5,6,7,27,56,70,75,100,113, 114,115,150/ 114,115,150/.

<sup>research</sup> is needed into the relatively unexplored area of taste perceptions in young children./129/.

Mine of the purchasers attitudes, preferences and reactions concerning their buying intentions./21,26,31,34,36,38,41,47,58,83,138,143,149/. The importance of taste panel members training has been recignized for a long companies.For instance, already for many years, training of taste panel members on Kulm Products assessment are arranged by the Federal Meat Research Institute in Kulmbach in collaboration with German Agricultural Society, and since first seminar till the seminar back and pressure the seminar back been trained and pressure till the end of 1979 almost 350 taste panel members have been trained and pressu $m_{ably}$  the similar amount was trained till now./54,55,146/.There are evidence that

In the majority of organoleptic investigations the taste panel is a laboratory type panel of trained experienced panelists most often drawn from institute staff, although external panels are used at some laboratories. The selection and training sults of organoleptic analysis, while representative consumer survay allow to deter-mine of the purchasers attitudes, preferences and reactions concerning their buying intentions (21, 26, 31, 34, 36, 38, 41, 47, 58, 83, 138, 143, 149).

and measurement of the meat and meat products guality by objective techniques as Well as applying subjective ones i.e.organoleptic analysis. Already in 1974 Tilgner /130/ stated that a bibliography of literature, up to 1966 Last 20 years many more literature data appeared and enriched our knowledge on sen-Borial properties of meat and meat products, on methods of the organoleptic evaluations of the sensoric features of the animal origin food products,on training of taste panels,on use of the instruments and interpretation of the instrumental findi-hgs,on statistical methods involved and mathemathical expressions of the analytical data

Such as: flavour, texture,aroma,colour,juiciness,consistency,tenderness etc. An enormous volume of scientific literature exists on the evaluation, assessment and

Many professional nutritionists are "non-testers" and do not appreciate the necessity to create flavourful diets and consider gastrology and gastronomy a negligible field of interest.Nobody likes bland, untasty, unpalatable food. The demand for flavour fulof interest.Nobody likes bland, untasty, unpalatable food. The demand for flavour ful-iness will be groving since the aroma and flavour of food together with its colour and texture are very often the determining factors influencing the consumer's appre-ciation of food. The aesthetic appeal of food is of paramount importance. Food which does not fulfill the consumer's expectations within a certain range of variation to which the consumer is accustomed, will be rejected /137/. It is obvious that those general statements of Prof. Tilgner are fully valid for publications on meat and meat products sensorical features and palatability attribu-tes, such as: flavour, texture, aroma, colour, juiciness, consistency, tendorness etc.

scored are:flavour,juiciness-tenderness,colour and overall acceptability.The category scales used may be either quantitative scales- measuring intensity of an attri-bute,or hedonic scales - indicating degree of proference. The devention used in the bute,or hedonic scales - indicating degree of proference. The description used in the scales vary and the number of categories range from 5 to 11. The large number of different scales used make comparisons extremely difficult. Data analysis of thise methods includes calculation of mean and standard distributions. thods includes calculation of mean and standard deviation and often further analysis of thise models by e.g.Student's t-test or analysis of variance, perhaps extended by multiple-comparisons tests e.g.Duncan range test.Non - parametric rank sum techniques and regression, and responce-surface methodology, have also been applied in some experiments./13,20,37,46,57,66,89,100,108,111,113/

regression, and responce-surface methodology, have also been applied in some of ments./13,20,37,46,57,66,89,100,108,111,113/. Within the past 20 years there has been a remarkable expansion in the use of multivariate statistical analysis to examine sensory data, and multicriteria, quantitarive-descriptive sensory methods, which applay principal- component analysis, cluster analysis /cluster maps and hierarchical clustering/, factor analysis, discriminant and stepwise discriminative analysis, canonical analysis etc./46,99,123,149/, and for presentation of the experimental findings specific configuaration graphs are in use and commonly recognized i.e.so called Quantitative Descriptive Analysis configurations.

The contemporary years of computers and microprocessors allows to make possible the computerization of sensory and other types of laboratories and has made inroads into the food scientists and concern dear into the food scientists and sensory analysts domain.Computer may be used for descriptive and discrimination testing,consumer testing and sensory research./14,25, 77,94,106,109,144/ 77,94,106,109,144/.

Organoleptic findings as well as technological processes oriented toward engine ering of the sensorial qualities of food are at present also recognized as an important factors in:marketing,operations,development and distribution of food products and are contributing to the wide scores of sense of a sense of the sens

tant factors in:marketing,operations,development and distribution of food products and are contributing to the wide scope of sensory evaluation./23,24,30,44,47,65,79, 82,93,116,127/.Sensory evaluation is also important for quality assurance and pro-ducts shelf live./37,85,101,147/. Our enjoyment of food is conditioned by sensory perception - sight,smell,taste, sound and touch.Sensory perception involves the interaction of several subtle ma-chanism and in most cases it is a composite image formed at the level of the cere-bral cortex as a result of the junction of all the information gathered by our five sences.

Simplifying the problem, every man when confronted with food, first makes a visual appraisal, which is an orderly and selective integration of a group of shapes, coloura

and intensities that provides a coherent impression. This visual impression is of great importance for it shapes consumer attitude and influences the appreciation of other senses.Physical contacts with food tricecore and influences the appreciation of other senses. Physical contacts with food triggers a group of sensory reaction and provides a welth of information such as on: temperature, consistency, plasticity and surface texture.

A new sets of physical sensations, which are related to: structure, texture, juici-ess, tenderness and chewability comes into play where the structure, texture, thus ness,tenderness and chewability,comes into play when the food enters the mouth. Thus, the sensations resulting from direct touching are complemented by those provided by tongue,teeth,palate and oesophagus, and at this level the tongue, teeth, palate and oesophagus, and at this level the associated sounds and mouth feeling influence the consumer perceptions and in general emotional reactions that Contribute to the appraisal of food.

Flavour of course are of paramount importance in our appraisal of food and deserve a special attention. The balance and interactions between testes and aromas give food in general, and meat and meat products particularly and testes and aromas give that that food in general, and meat and meat products particularly, a unique characteristic

establish its identity. While the number of basic testes is relatively limited, the diversity of aromas that can be achieved and perceived attains the limits of human sensibility. And lat last but not least the processing technology including such as curing, smoking, manufacturing fermented products etc., great diversity and assortments of spices in use, and the art of cooking consists of combaining these sensory feelings in proportions that evoke positive reactions in the mouth and in the mind to fix a clear and appetizing image.

It is commonly recognized that food as such, and meat and meat products in parti-cular, is appraised on two levels - the nutritional and the sensorial. The sensory properties are at least important as the nutritional properties, convinience, and va-lue for money and are contributing to the low of living

properties are at least<sup>24</sup>Important as the nutritional properties, convinience, and lue for money and are contributing to the joy of living. Flavour is one of the most important quality attributes of meat. The chemistry flavour is a very complex area, and the number of papers published on meat flavour has increased considerably in the past ten yéars. This proliferation of publications and renewed interest in flavour research has been attributed to an expanded effort to provide flavour control and modification for a large number of food products. tar vour, being the sum of several sensory responces to food taken in mouth, i.e. odor jua ste, and mouthfeel, depends in large on lipid components of food which perform as up or se, as precursors and as flavours carriers, while the flavour molecules in-teract in number of ways: additively, synergistically and antagonistically. Among a number of excellent review articles and special reports on meat flavour the paper by W.G.Moody, which appears in 1983, and which reviews some of the important the paper by W.G.Moody, which appears in 1983, and which reviews some of the important

Ach Justified instrumental texture analysis and appropriate selection of ach Justified instruments among many different constructions of the texture testing for the selection of available laboratory equippment being in use whe purpose, such for instance like most popular Instron Universal Testing Machi-in the Bartzler or Kramer shear device, Ottawa Texture Measuring System, different iter of penetrometers etc.No less important and as well extensivelly presented in the a problem related to texture /tenderness/ assessment i.e. the seman-or expressions of the measured indices involved, their multiplicity and diversi-

The increased production and consuption volume of processed meat and restructured products necessitates the development of new approaches to measure meat texture to the increased products are more complex than in-Since The products necessitates the development of new approaches to measure meat texture act this products often possess textural properties that are more complex than in-ind muscle products.Some of the procedures employed do not provide the reliability movies of desired results.This problem is partially due to incomplite basic The another very broad and relatively exhaustively elaborated subject concerns the methodology of the instrumental texture analysis and appropriate selection of the statified instruments among many different constructions of the texture testing

ucial importance to the manufacturer and underlines that the expert must or ought base his judgement on an acquired understanding of sensory examination procedures the results also with regard to tenderness, juiciness etc./133/. For a first time survay is also given by Prof.Tilgner on a new field i.e. on ba-tod additive concepts and the physiology of man's sense of hearing in relation to taxturology, odontology and auditive perceptions, that pitch, volume duration of the tart and evenness and unevenness of biting and chewing noices can be used to chara-tied and interpreted by measurements using oscillographic recordings, various kind of The grams and tone spectra./134/. "Bate increased production and consuption volume of processed meat and restructured tart increased production and consuption volume of processed meat and restructured tart.

In a another paper entitled "Meat texture and rheology", Tilgner is of the opinion that trucial importance to the manufacturer and underlines that the expert must or ought

clature or sensory terms for the texture are given. The second part of the paper by have same author /132/ deals with the practice of texture analysis by sensory mea-texture profile analysis is being regarded as the clasic objective method of measu-sensory quality complex and in spite of all the refinements in measurement techniqu-tion only be unravilled by trained testing panels able to analyse their own rea-

<sup>ha</sup> determination and assessment are also provided./88/. The texture of food in general, and in relation to maat and meat products, and par-ticularly to meat tenderness, has been for a long time recognized as a quality attri-bute ticularly to meat tenderness, has been for a long time recognized as a quality attri-bute contributing to the enjoyment and acceptance of our daily meals. However, proba-remedial action in the hands of the consumer, texture did not command as much consu-mer oriented research as did flavour and colour, no doubt with exception of meat and Properties of major importance to the acceptability of meat and meat products, as apper by Tilgner /131/ the definition of the physical properties such as:consisten-cy, structure, firmness and texture, and the descriptive evaluation of texture and the characteristics of substances, as well as about 100 bilingual German/English nomen-

A problem which deserve special consideration is related to flavour enhancing and to the relevant active substances commercially used for the purpose also in me-at industry i.e. flavour enhancers, but time allocated for this review prevents me from detailed elaboration on these matter, and allows only to recommend you, as an example, the paper by Oberdick, entitled "Flavour enhancer" and published in the Die flaighbut trocheft, and to which physicalectical considerations recording tests and are Eleischwirtschaft, and in which physiological considerations regarding taste and aro-determination and assessment are also provided./88/.

research developments in beef flavour that have occured during the past two decades, and those by D.A.Baines and J.A.Mlotkiewicz,published in 1984 in "Recent advances in the chemistry of meat", deserve to be mentioned particularly./17,81/.Many other publications on the subject matter also deserve to be mentioned as they are dealing ding spices,or with special narrow aspects involved, and/or with methods of flavour analysis./16,18,28,29,35,51,52,59,61,71,73,78,91,105,125,136,137,141/. Irrespective of great progress and developments of analytical methods the opinion mical and instrumental methods, is still valid.Certain chemical and instrumental me-thods, such as gas chromatography, are useful in quality control to monitor threshold in chemical/instrumental methodology that will be more useful in predicting meat flavour and aroma.Because sensory evaluation is the ultimate authority in determi-In Chemical/instrumental methodology that will be more useful in predicting meat flavour and aroma.Because sensory evaluation is the ultimate authority in determi-tang meat and processed meat products flavour, it is apparent that we must relly on taste panels for meat sensory evaluation.However, laboratory panels should be adequ-atly trained and used as an "analytical tool" or "instrument" to yield sensory dis-crimination or sensory intensity data./38/.

ty and great discrepancy between nomenclature used, although recently some approaches to systemize of the organoleptic terminology and the objective expression of research findings particularly these of instrumental entry of the organized of the second s search findings, particularly those of instrumental are in progress./ 1,2,20,33,38, 43,63,64,68,82,84,87,95,102,103,112,124,126,131,132/. Recently published paper by Berry and Leddy,should be considered as an excellent

and very informative publication on present complexity in defining characteristics and procedures involved in the texture profile panel for ground beef patties, parti-cularly from methodological poin of view, and deserve to be pupularized for educa-tional and research activities (22) The parts by Kerter at a straight of the muth phy tional and research activities./22/.The paper by Keeton et.al which deals with phy sical and sensorial properties of frankfurters belong to the same category of pu-blications./62/.Worthy to be mentioned is also a paper by Hamm on relationships be-tween water binding capacity of meet and the ca een water binding capacity of meat and the sensory factors of meat quality /53/. The second main topics I ought to elaborate on during these session reffers to tween water

automated systems and instruments for controlling the quality of meat and meat pro ducts.

Analysis of multi-component meat systems has always been difficult and all the conventional, standard, chemical procedures are to slow to serve as a practical means for monitoring or controlling the various stages of meat products manufacture on a modern high-speed line appart from being vary wars. a modern high-speed line, appart from being very costly and labour and time consuming

Therefore, the future of the subject under consideration belong to, and will gre atly depend on the progress in instrumentation and particularly in automation of routine assessment and accurate determination and particularly in automation of routine assessment and accurate determination of meat and meat products constitu-ents, reflecting raw material composition, the degree of obeying of the standards and evaluating of the nutritional value of final products. An excellent review, presenti-ng and discussing the up-to-date developments in analytical techniques relevant to meat industry was published just recently i.e. in 1984 by Patterson in a monography entitled: "Recent advances in the chemistry of meat"./92/.The author is directing a readers attenntion on two infrared apectrometry instruments for measurement of indireaders attenntion on two infrared apectrometry instruments for measurement of ind vidual components of multi -component meat mixtures i.e. on InfraAlyser 400 and Super Scan both working in different region of the Near Infrared spectrum, indicating that different types of product require different eater of and the sectrum. vidual that different types of product require different sets of calibration constants but once established routing analysis of require different sets of calibration constants but once established, routine analysis of product line becames simple and rapid and can

be carried out in less than 5 minutes each. Assessment of the newer analytical techniques and instruments were conducted by several authors and their findings demonstrate that it is possible to obtain eatier factory quantitative results for the analysis of meat and meat productd./11,69,72, 80,103/.Moreover.regarding the subject methods is a mend 80,103/.Moreover, regarding the subject matter it seems to me justified to recommend

you acquintance with papers on rapid methods for the determination of fat, moisture and protein which were published in 33rd /1980/ and 37th /1984/ volume /issues/ of the Proceedings of Annual Reciprocal Meat Conference of Amer.Meat Sci.Assoc./90.96/, as well as those of Arneth (9.10/ and with Converse of Amer.Meat Sci.Assoc./91.19/. as well as those of Arneth /9,10/,and with 2 russian authors review papers./67,119/. Recently scanning instruments e.g.Neotec 6350 have appeared,and at the moment are

Recently scanning instruments e.g.Neotec 6350 have appeared, and at the moment a probably best considered as research tools although many factors of meat or meat -product samples may affect the results and require eluci-dation before the techni-jue will be able to replace conventional analytical methods or compete with other rapid methods, as for example with Super Scan IR Analyser./92/.

Ion-selective electrode system and ion chromatography are of very valuable ana-lytical tool for rapid determination of great selection of inorganic ions in meat product such as: sodium, potassium, calcium, phosphorus, nitrite, nitrate and many other, /15,42/.High-speed liquid chromatography also offers new possibilities for improved meat and meat product analysis./39/.Very interesting and informative selection of the papers was presented during 1983 IFT - IUFoST basic symposium on "Modern methods of food analysis", including such topics as: reflectance spectroscopy flow topiction

the papers was presented during 1983 IFT - IUFoST basic symposium on "Modern methods of food analysis", including such topics as: reflectance spectroscopy, flow injection analysis, atomic absorbtion and plasma optical emission spectrometry, determination of nutrients in food, determination of flavour components, sensory analysis as an analysical laboratory tool in food research etc./8/. A very succesful developments are observed in elaboration of automated techniques and methods for microbiology. Several rapid procedures have been proposed to overcame Standard Plate Count. These include: ATP photometry, radiometric measurements and im-pedimetric detection, the last is considered to be the most promising of these inst-rumental methods. Impedance changes associated with microbial metabolism could be de-tected using a Bactometer Microbial Monitoring System M-120B /Bactomatic, Princeton N.J./, which is fully authomated system capable of monitoring up to 128 samples and is structured around a 16-bit microcomputer. The high correlation between the impe-dance detection time /IDT/ and the colony forming units /CFU/ indicates that the impedimetric estimation of microorganisms concentration can provide substantially, 50,120/. The third tonic which should be dealt with in the microbial quality e.g. of beef.

The third topic which should be dealt with in these review concern the additives and their influence on the quality of the meat product.I do need to convince anybody that such a broad problem cannot be as it deserve alaborated to not be used. that such a broad problem cannot be, as it deserve, elaborated in one brief review. Therefore I will only to touch the subject matter.

Food additives, according to Methews and Steward /76/ could be divided into two groups: 1.processing additives - i.e.for the substances which are used at the indust trial level to facilitate the processing, storage, handling, or packaging of food, and in general are not functionally active in final product, although they may, as a result of good manufacturing practices, remain in the final product at low concentration, and 2.<u>final product additives</u> - and these substances are intentional constituents of the final product and generally remain functionally active following

The additives are than further clasified into categories according to their technical effect and to the first group, among other, belong such agents like: aerating /foaming, colour control, catalysts, freezing/cooling, pH control agents and so on, and to the second group such as: antimicrobial, antioxidant, apperance control, cclours and colour modifiers, flavours and flavours modifiers, nutrients, sequestrants, texture /consistency control, emulsifiers, stabilizers, texturizers etc., agents.

The selection and variety of the additives used by meat industry is quite a numerous.Terrall /128/ attempted to offer sugestions on classification of the additives onto such classess as: curing-preservation agents, curing accelerators, sensory enhancers /which include such as: sugars, spices, liquid smoke preparations, starter cultures, enzymes, phosphates etc./stability -shelf live enhancers, chelating agents, form modifiers: the last include: protein products of plant and animal origin such as: floure, concentrates, isolates and texturized oil-seed derived protein preparations, sodium caseinates, blood plasma, gelatin, mechanically separated meat etc./. From functional point of view the additives could be classified on: binders, fil-

From functional point of view the additives could be classified on:binders,fillers,extenders,acidulants,stabilizers,increases yield,improves flavour and slicing, reduces residual nitrite,decreases and increases of pH,reduces cost and the like. There are in professional technical and scientific literature countless of pa-

There are in professional technical and scientific literature countless of papers and numerous reviews and monographs on the additives used by meat and food industry, on their functional properties, technological effects and on its influence on meat products quality, but due to self-evident limitations I am in position to mention only very few of them as for example some of those dealing with nitrites /86,97,145/, phosphates /121,139,140,142/, sorbates /74,104,117,118/, acidulants /48/, Protein preparations /40,45,107,148/, liquid smoke preparations /98,110/ and chemical conservants for meat and meat products /122/, being of course convinced that respective available literature sources are much more numerous. For the determination of ingredients and additives in meat products a isotachophoretic analysis is recently recommended./12/.

recently recommended./12/. I would like to end these introduction to the present session with statements of Prof.Tilgner,that:"If people care for good flavourfull food,their style of ea-

ing will consequently be good and probably the style of working and living, as well the art and science to produce good food gives pleasure and incitement to other peo ple."Let us all involved in meat acience and research, in implementation of the scie ntific findings, and in daily activities in meat plants to follow and to materialithose thoughts of Prof.D.J.Tilgner.

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