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PROPOSITION OF T. N. N. EQUATIONS IN THE KINETICS OF ENZYMES

By

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CONTENTS

Introduction

As already reported,[48] many theories and equations have been proposed in the kinetics of enzymes. The author has made it certain that no one of the equations can be applied generally even for one kind of enzyme but each of them can be accepted as apparently applicable to the data of special cases. In the investigation of soy bean protein the author decomposed it with pepsin, pancreatin and papain, taking the length of time, the relative quantity of enzyme or the quantity of substrate as a variable. He endeavoured to find some equation applicable well with no exception at least to his data. He could find some equations applicable well with no exception at least to his data. He tried to apply the equations to many published data. The results were satisfactory for many enzymes. One of the equations was always better applicable than any one ever before proposed according to the kind of enzyme or to the kinds of enzyme and substrate. He tried to examine the principal theories or equations in the kinetics of enzymes proposed by preceding investigators. He can point out some defects or mistakes in them. The author wonders by what examination they determined the applicability of their equations. He proposes several items for examining the applicability of equations most of which have not been taught in enzyme chemistry or perhaps in the kinetics of general chemistry for these several decades. Furthermore he is going to propose some new equations which will have wide application. Not only to data obtained in experiment with time but also to data with the relative quantity of enzyme or the quantity of substrate as a variable, do the equations seem to be satisfactorily applicable.

Decomposition taking time as a variable

1. Nomenclature of equations to be proposed

NAKAMURA's equation, $\dfrac{1}{t^{k'}} \dfrac{x}{a(a-x)} = K$ and the equation, $\dfrac{1}{t^{k'}}$ $\log \dfrac{a}{a-x} = K$ which was formulated by the present author were

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The author has reported a paper under the topic " Generally Applicable Equations in the Hydrolytic Reactions in Enzyme Chemistry (Japanese)," in Journ. Agr. Soc. Japan from Apr. 1931 to Nov. 1932. The present paper contains the principal parts of it, making the necessary corrections.

applied to the data obtained by the latter in the decomposition of protein and oil with various enzymes. The modified forms of these equations were also applied to the data obtained in the decomposition taking the relative quantity of enzyme or the quantity of substrate as a variable. The author considersed that NAKAMURA's equation was the general form of the bimolecular equation and that his own equation was the general form of the monomolecular equation. In the same manner, the general form of higher orders,

$$\frac{1}{t^{k'}} \frac{1}{n-1} \left\{ \frac{1}{(a-x)^{n-1}} - \frac{1}{a^{n-1}} \right\} = K$$

is considered. These general forms are here, for the sake of convenience, named as follows:

$$\frac{1}{t^{k'}} \log \frac{a}{a-x} = K \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{T.N.N.I,}$$

$$\frac{1}{t^{k'}} \frac{x}{a(a-x)} = K \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{T.N.N.II,}$$

$$\frac{1}{t^{k'}} \frac{1}{2} \frac{2ax - x^2}{a^2(a-x)^2} = K \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{T.N.N.III,}$$

$$\frac{1}{t^{k'}} \frac{1}{n-1} \left\{ \frac{1}{(a-x)^{n-1}} - \frac{1}{a^{n-1}} \right\} = K \ldots\ldots\ldots\ldots \text{T.N.N.N,}$$

where T is the capital letter of TADOKORO, under whose leading the author proceeded with the study, the second N that of NAKAMURA who is the finder of the equation of T.N.N. II itself and the third N denotes NAKAJIMA, the finder of T.N.N.I and the proposer of T.N.N. equations as generally applicable equations. Each, I, II etc., shows the order of the equation when each $k'=1$. The author is going to propose these T. N. N. equations as general equations in the kinetics of enzymes.

2. Meaning of the application of the kinetic equation and examples showing the imperfection or mistakes of some kinetic theories

If we strictly examine the applicability of equations each of which has been proposed to be well applicable to some data, we can recognize that some of them are of true application while the others are only of apparent application. According to the writer's examination and opinion most of the equations which have been proposed in *enzyme kinetics* are of the latter kind. If the application of an equation is only

apparent, it has no direct relation with the chemism or chemical nature of each component though the applicability may be very high. But the equation of true application is considered to give suggestions regarding the chemism. In the chemical change between two components whose chemical structures relating to the change are known, we can understand that the true-application kind of equation has a close relation to the structure of both components or to the chemism between them. And on the other hand we can also suggest the structure of the chmicals by the true-application kind of equation. For instance we can suggest the chemism between two components by the true application of the monomolecular or the bimolecular equation. Therefore a truly applicable equation is a key to open the unknown chemical nature of components or the chemism between two components. Because of this important significance of the application of equations, many investigators have endeavoured to find such equations, and notwithstanding their endeavour the apparently applicable equations have little value, while on the contrary, as the equation of true application has such an important meaning, the apparently applicable equation which was considered mistakenly to be truly applicable by each author made him often reach a mistaken theory. Northrop's theory which was introduced by the mistaken acknowledgement of the Schütz law is such an example.[48] The present author has examined many theories and equations in enzyme chemistry proposed by preceding investigators to try to find some truly applicable equations among them, but the endeavour was not requited with success. He was able unexpectedly to point out defects in many theories or the mistaken application of equations. Some of them are shown below.

1)   Arginase

Gross[29] decomposed arginine with arginase, to the data of which he applied the monomolecular equation and obtained the result given in Table I. Gross attended to two facts. (1) As shown in the table the value of K decreases with the increase of decomposition-time. (2) After 24 hours of decomposition he added 5 cc. of enzyme solution. Two hours after the addition, the decomposition proceeded to 75% with an increase of only 3%. From these two facts the author considered that the decomposition velocity decreased markedly and attributed it to the injurious effect of the decomposition product—ornithine. The present author applied T. N. N. II to his data with the result given in Table II. The equation is surely well applicable. Gross suggested the velocity

of decomposition by arginase from the premise that the decomposition
followed the monomolecular equation, which premise made him reach
his conclusion. But although the value obtained in the decomposition
by the further addition of a comparatively large amount of enzyme was
so little as 3%, it cannot induce his conclusion. In this case the quantity
of substrate was little and the decomposition must have followed also
T. N. N. II with the values of K and k', which are quite different from
those in the first step of decomposition. The writer thinks that the
decomposition velocity has no relation to the monomolecular equation.
Therefore the two facts pointed out by GROSS give no reason to accept
the theory of the injurious effect of ornithine.

2) Invertase

In the kinetics of invertase many theories and equations have been
proposed. MICHAELIS and MENTEN[44] deduced an equation from theoreti-
cal examination. Their equation coincides with HENRI's equation for-
mulated independently. The two equations are given below.

$$\frac{1}{t}\left(\frac{1}{a}+\frac{1}{k_1}+\frac{1}{k_2}\right)a\cdot ln\frac{a}{a-x}+\frac{1}{t}\left(\frac{1}{k}-\frac{1}{k_1}-\frac{1}{k_2}\right)x=\text{const.}$$

$$m\cdot ln\frac{a}{a-x}+n\cdot x=t\cdot\text{const.}$$

Although MICHAELIS and MENTEN deduced their equation from care-
ful examination it does not always agree with experimental results.
After examining the examples which were shown by the authors to
prove their theory and equation to be true, the present author cannot
accept their proof. One of the examples is given in TABLE III. The
values of K are apparently uniform. But the two extremes are 0.0407
and 0.0496, the ratio of which is not so small, as it is 100:121.9.
Moreover the range of decomposition is so very narrow as to be under
20%. Within such a narrow range one must be careful especially as
to the uniformity of the values of K and the increasing or decreasing
tendency of the value of K. Their experimental results cannot satisfy
these important examinations. MICHAELIS and MENTEN's theory was
studied by many investigators and was said to have many defects both
in the theoretical and experimental researches.[54] It seems that the
deeper the theoretical research the more difficult it is to find a satis-
factory equation. The present author is going to apply T. N. N. equations
to MICHAELIS's data and examine the applicability of them. The data

of the widest range of decomposition among the original examples shown in TABLE IV are taken. The applied result of T. N. N. I to the data is given in TABLE V. As shown in this table, each difference between experimental and calculated values is large and the equation cannot be said to be well applicable. But in the application of equation one or two special data in an experimental result occasionally give to the whole calculated result such a deviation as makes one misjudge the applicability of the equation and suppose it is not true. For trial the writer applied again the equation to the above data omitting the last term as MICHAELIS did for this result in the original paper. The calculated result is given in TABLE VI, where the applicability is accepted to be satisfactory. For the data here taken, the values of K of MICHAELIS's equation are not uniform, as their two extremes are 0.0405 and 0.0489 and their ratio is 100 : 120.7.

The author has examined MICHAELIS and MENTEN's equation using their own experimental results and shown the defect of it. The applicability of his equation, T. N. N. I, to the same data is proven above. Therefore their theory is considered also imperfect. The premise of the impossibility of finding a satisfactory equation in the kinetics of invertase seems to disappear.

3) Catalase

ISSAJEW[37] obtained catalase solution from yeast, and applied the monomolecular equation to his data. The data was considered by him to follow the equation. EULER[21] considered in the same manner his data obtained with fungus extract. FAITELOWITZ[56] obtained data with milk catalase to find some applicable equation. In the decomposition at $25\,^{\circ}$C with a large quantity of catalase for dilute substrate, it followed the monomolecular equation but the decomposition velocity for the substrate was thought to decrease with the progress of the decomposition of the catalase itself. The decomposition of catalase was thought to be weaker for high concentration than for low concentration of H_2O_2. For a definite concentration of H_2O_2 the increase of decomposition velocity was comparatively little and was not proportional to the increase of catalase. BACH[7] studied the catalase of sebaceous tissue. In the decomposition of much H_2O_2 with much catalase he thought that the decomposition took place proportionally to the quantity of substrate or enzyme. SENTER[66] thought that his data obtained with blood catalase followed the monomolecular equation. MORGULIS[47] recognized that the

decomposition by catalase took place proportionally to the quantity of enzyme or substrate. When much quantity of the enzyme was taken, the monomolecular eqnation was well applied, while in the decomposition of under $2/3$–$4/5$ part of the substrate the bimolecular equation and, in the decomposition of medium degree, the $1\frac{1}{2}$ molecular equation was applied well to the data. Rona and Damboviceanu accepted Morgulis's conclusion. They applied equations to their data as given in Table VII.

In the decomposition of H_2O_2 by catalase, Yamazaki[85] supposed two independent processes the velocity of each of which was considered to be constant through the entire decomposition. Each velocity was given as follows:

$$-\frac{d\,E}{d\,t} = K$$

$$-\frac{d\,c}{d\,t} = k\,E\,c$$

where E denotes the concentration of enzyme, c the concentration of H_2O_2, K and k are constants. By integration,

$$\log\frac{C_o}{c} = \log\frac{C_o + a}{c + a} = k'\,a\,t$$

was obtained where C_o denoted the concentration of H_2O_2 at the beginning of decomposition, c the concentration after t hours, k' equals kK, and a the integration constant. He made many elaborate experiments. Maximowitsch and Awtonomova[44] also supposed two processes in the decomposition by catalase such as,

1. Decomposition of H_2O_2 by catalase,
2. Breaking of catalase by H_2O_2

which were denoted as given in the following equations

$$\frac{dx}{dt} = C\,(A-x)\,(B-y) \quad \dotfill \quad (1)$$

$$\frac{dy}{dt} = C_1\,(A-x)\,(B-y) \dotfill \quad (2)$$

where A and B mean the concentration of H_2O_2 and the concentration of catalase both at the beginning of decomposition respectively, x the quantity of H_2O_2 decomposed in t hours, y the quantity of enzyme decomposed in t. As $C \neq C_1$, deviding (2) by (1) $\frac{dy}{dx} = \frac{C_1}{C}$ results,

which will be represented by E, and $\dfrac{B}{E}$ will be denoted by D. The authors obtained finally the equation,

$$C_M = \frac{1}{t}\,\frac{1}{A-D}\,\log\frac{D(A-x)}{A(D-x)}.$$

From the data of their experiment they calculated the values of the constant of their equation, and they thought that their equation was perfectly applicable. As they said, although the equations of MAXIMO-WITSCH and YAMAZAKI are different from each other in form, they each deduced independently their respective equation from the same point of view. Therefore the meaninings or the values of applicability of their two equations are quite the same.

The principal kinetic theories of catalase are given above. The author will show hereafter the incompleteness or defect of some equations. The incompleteness or defect of these theories from which the equations were deduced will be accordingly understood. The applied results of T. N. N. equations will be given at the same time to show the good appli-cation of them. The result obtained by ISSAJEW in the application of the monomolecular equation is given in TABLE VIII. As seen in this table, the uniformity of the values of K is constant. The writer applied T. N. N. I and II equations to the same data as given in TABLE IX. As the probable error for equation I is very near to 1, the monomolecular equation can be said to be satisfactory. The same conclusion can be deduced from the result when applied to another example as shown in TABLE X.

EULER recognized the good application of the monomolecular equation to his data obtained by catalase of shaggy boletus which are given in TABLE XI. The present author applied T. N. N. equations to EULER's data, from which T. N. N. II is clearly accepted to be satisfactory as shown in TABLE XII. From the results of the application in this table it seems that the applicability is high in the order of T. N. N. II, T. N. N. I and the monomolecular equation.

SENTER recognized the satisfactory application of the monomolecular equation to his data, obtained by blood catalase as given in TABLE XIII. To the same data the present author applied T. N. N. equations. T. N. N. I is distinctly better applicable than II and the value of k' of T. N. N. I is almost equal to 1 as shown in TABLE XIV. Therefore

no perceptible difference of applicability can be seen between the monomo-
lecular equation and T. N. N. I.

Next T. N. N. equations will be compared with Yamazaki's equation
for his same data. From many results of Yamazaki some of them
were taken at random to which T. N. N. equations were applied as
given in Table XV where T. N. N. I is distinctly better applicable
than II or Yamazaki's equation. The value of k' of the last equation
is first large and becomes little and so the equation is not adequate to
maintain his theory. Yamazaki himself pointed out the defect of his
equation in this fact. To his data, T. N. N. I was always best applicable,
examples of which are shown in Tables XVI—XIX.

The applicability of Maximowitsch and Awtonomova's equation
will be next examined. The proof of the equation by the authors is
to be regretted in soma points. First, although they gave many
experimental results these are not adequate to examine the applicability
of an equation because the range of decomposition is not wide. The
present author calculated the range by the formula $(x_e - x_f)/a \times 100$
where x_e is the quantity of substrate decomposed for the longest time,
x_f that for the shortest time and a is the quantity of substrate taken.
From the data of Maximowitsch, the present author calculated the
ranges for all results, some of which is as little as only about 2 to
7% and even the widest range is about 35%. Secondly, to calculate
each value of the constant of their equation, he took the mean value
of D of his equation by averaging the calculated results of a very
indefinite number, for instance, they took the mean value of D from
10 calculated results for 6 experimental data of one group, while in
some other case they took the value averaging only 3 or 4 calculated
results for 6 data of another group. At any rate the present author
applied T. N. N. equations to their data. T. N. N. I was always better
applicable than II. Some examples are shown in Tables XX—XXVII.
As seen in these tables the values of D are not quite uniform. When
the values of K of the monomolecular equation are comparatively given,
the values of C_M seems very uniform, but the two extremes are 32 and
29 which are 10% different from each other. On the other hand,
T. N. N. I is satisfactory. In other examples the same defects of
Maximowitsch's equation as explained in the previous example can be
pointed out while T. N. N. I shows always good application.

Some of the data of Rona and Damboviceanu, which were shown
by them to follow $1\frac{1}{2}$ molecular equation as Morgulis's theory will be

given. To these data T. N. N. II shows its perfect applicability as shown in Table XXVIII and XXIX.

3. Necessary items for examining the applicability of equations

In the examination for applicability of an equation several items must be mentioned. If one or two of them are overlooked it is usual to overestimate the applicability of the equation. However, such important items have never been taught in enzyme chemistry although one or two of them were usually attened to in each of the preceding studies on kinetics. The author considers that at least all the following several items are to be attended to in examining the applicability of equations.

(A) For the experimental data in regard to which the applicability is to be examined, it is necessary to attend to the following :

(i) *Range of decomposition*

If a certain equation is applied to data with the range of decomposition $(x_1 - x_2)$ %, the applicability is to be discussed only within that range of decomposition. Even if it is proved to apply well for that range, the applicability to the data beyond that range is quite uncertain. If the application is proved to be true for a wide range of decomposition, it holds true for a narrower range. Therefore, one must attend to the applicability of the equation as well as to the range of decomposition for the applied data. To make clear such an explanation, consider an experimental result with its plotted curve on coordinates. If a short part of the curve be taken, it can be treated as a straight line or as the curve of some other kind without much impropriety. If a long part of the curve be taken, the impropriety caused by such treatment cannot be negligible. There have been many studies which treated the data within only several % of decomposition to examine the applicability of equations, but such an examination, or the equation whose applicability was proved with data of such a narrow range of decomposition, has almost no meaning or value.

(ii) *The number of experimental terms should not be few*

If an equation is applied to data of few terms the applicability is often mistakenly estimated. Consider that many points for experimental data are arranged on a line for a certain equation. If only two or three points among them are taken, there can be many curves satisfying these points. But if many points are taken there can be only a curve which

satisfies any of the points.   On the other hand, if the number of terms
are few the experimental or accidental error for each datum has much
influence on the value of constant of the equation.   Therefore the data
of few experimental terms are not sufficient to examine the applicability
of equations.   The larger the number of terms the better.

(iii) *Examination by plotting the curve of experimental result*

It is an easy and very important method to examine the experi-
mental data by plotting them before applying the equation to the data.
The points on the coordinates for experimental result are generally on
a smooth curve and if one or two special data are plotted distinctly
out of the curve they are considered to be data with accidental error
and therefore they are not to be taken in applying the equation.

If one takes all the data without selection in applying an equation
it shows sometimes an apparently good application while the true fact
is the contrary.   Such mistaken proofs can be seen often among the
preceding reports.

(iv) *The nature of the equation to be examined and the nature of
the experimental curve must be the same*

The equation was sometimes examined for data without being
considered the nature of the equation and experimental curve.   By such
an examination no perfectly applicable equation can be found.   For
instance, in the decomposition of starch the maximum hydrolyzable
quantity that is obtained with amylase differs from that with hydro-
chloric acid.   To the data obtained with amylase the monomolecular
equation was sometimes applied by taking the quantity of glucose
equivalent to the quantity of starch (obtained in the decomposition with
hydrochloric acid) as the value of a in the equation.   But in such
a case the maximum hydrolyzable quantity of the substrate taken that
is obtained by the enzyme action must be taken as the value of a
(cf. page 168), and the percentage of the substrate decomposed must
be calculated by taking that maximum quantity as the base.   On the
other hand, for instance the monomolecular equation, which passes
through the original point was sometimes applied by some preceding
investigators to data which did not pass the original point.   In such a
case the equation must be applied to such data that are obtained by
subtracting the experimental value at the beginning from each experi-
mental value as some other investigators did.

(B) In estimating the applicability of equations it is necessary to
examine :

(i) *The uniformity of the values of the constant and the difference between experimental and calculated values*

The applicabilities of two different equations have been very often compared with each other only by the uniformity of the values of the constant. But such a method only is inadequate to determine the better applicability; and the mean differences between experimental and calculated values or probable errors for both equations must be compared as already reported.

(ii) *Is there or is there not a certain definite tendency in (a) the values of the constant or (b) the differences between each pair of experimental and calculated values in the result obtained?*

If the equation is perfectly applicable the positive or negative sign of the difference between the experimental and the calculated values must occur irregularly and the absolute sum of the positive differences must be about equal to that of the negative. Such a fact means to follow the principle of probability itself. Therefore if one observes "the increasing or decreasing tendency of the value of a constant", or " such a tendency in the value of the difference between each pair of experimental and calculated values" or " such a tendency in the occurrence of the sign of the values of the difference," then one can not recognize the perfect application of the equation even though the degree of the tendency is slight.

4. Application of T. N. N. equations to published data

The applicability of T. N. N. equations to some data has been proven in this paper and in a previous report.[49] Here the author is going to show collectively the results of the application of T. N. N. equations to data obtained by himself and to data obtained by preceding investigators with enzymes of various kinds. He takes data from as many reports as he can find. The author will not show or criticize all the theories in enzyme kinetics which have been proposed by preceding scholars. The several items which were mentioned under paragraph 3 are to be always kept in mind in the following examinations.

Lipase and esterase

A) Plant lipase

1) Castor bean lipase

(i) Data obtained by NAKAJIMA in the decomposition of soy bean oil. T. N. N. I is satisfactory.[49]

(ii) Data obtained by NICLOUX[53] in the decomposition of cotton seed oil. The applicability of the monomolecular law was supported. The data taken for an example does not plot a smooth curve. To the data T. N. N. I is applied, which is better than the monomolecular law though it is not perfect as seen in Table XXX. This is due perhaps to the fact that the viscosity of each sample was not constant through all the time of decomposition.[48]

(iii) Data obtained by WILLSTÄTTER and WALDSCHMIDT-LEITZ[82] in the decomposition of olive oil. T. N. N. I is satisfactory. (TABLE XXXI).

(iv) Date obtained by WILLSTÄTTER and WALDSCHMIDT-LEITZ[83] in the decomposition of castor bean oil. T. N. N. I is satisfactory. (TABLE XXXII).

(v) Data obtained by TAYLOR[71] in the decomposition of triacetin. T. N. N. I is satisfactory. (TABLE XXXIII).

As examined above T. N. N. I is always satisfactory for data obtained in the decomposition of any substrate by castor bean lipase.

2) *Papain lipase*

(i) Data obtained by NAKAJIMA in the decomposition of soy bean oil. T. N. N. II is satisfactory.[49]

(ii) Data obtained by SANDRERG and BRAND[64] in the decomposition of olive oil. T. N. N. II is satisfactory. (TABLE XXXIV and XXXV).

3) *Lipase of fly amanita*

Data obtained by ZELLNER.[86]   T. N. N. II seems satisfactory (TABLE XXXVI).

B) *Animal lipase*

1) *Lipase of stomach*

Data obtained by STADE.[69] The equation $K.F = \dfrac{F}{t} \log \dfrac{a}{a-x} - \dfrac{x}{t}$ was reported by ARRHENIUS[5] to be satisfactory. This equation is unsatisfactory as shown in TABLE XXXVII. T. N. N. I is always more satisfactory than T. N. N. II as shown in TABLE XXXVIII. T. N. N. I is not quite satisfactory, perhaps due to the fact that the data do not fall on a smooth curve.

2)   Pancreas lipase

(i)   Data obtained by ENGEL[19] in the decomposition of egg-yolk. The SCHÜTZ law was accepted by ENGEL. The results given in TABLE XXXIX seem not proper and are not adequate for examining the applicability of equations. With such incomplete data the applicability of any equation cannot be determined.

(ii)   Data obtained by WILLSTÄTTER and MEMMEN[77] in the decomposition of triacetin. The SCHÜTZ law was supported. As seen in TABLE XL, no perceptible difference of applicability can be seen between T. N. N. I and II.

(iii)   Data obtained by DIETZ[16] in the synthesis of ester. The reaction in the presence of little water was thought by Dietz to follow the equation $\frac{dx}{dt} = K\ (a-x)$. But, T. N. N. I seems to be best applicable as shown in TABLE XLI.

(iv)   Data obtained by DIETZ in the synthesis of ester in the presence of comparatively much water. The opposite kinds of reaction were considered by DIETZ thus,

$$\frac{dx}{dt} = k_1(a-x)-k_2x.$$

At the equilibrium of reactions $\frac{dx}{dt} = 0$. If the quantity of x at the state of equilibrium be represented by ε the following equations were obtained by DIETZ:

$$\frac{C_E}{C_S} = \frac{k_1}{k_2} = K = \frac{x}{a-x} = \frac{\varepsilon}{a-\varepsilon}$$

$$k_1 = \frac{1}{t}\,\frac{\varepsilon}{a}\,ln\frac{\varepsilon}{\varepsilon-x}\ ;\ \ k_2 = \frac{1}{t}\,\frac{a-\varepsilon}{a}\,ln\frac{\varepsilon}{\varepsilon-x},$$

$$k_1+k_2 = \frac{1}{t}\,ln\frac{\varepsilon}{\varepsilon-x}.$$

To the data which were obtained by him with the solution of 6.5% water and 5.01 g of enzyme, T. N. N. I and II were applied as given in TABLES XLII–XLIV. The result of application of T. N. N. I, omitting the fourth datum which is certainly out of a smooth curve, is given in TABLE XLIV. As seen in these tables T. N. N. I is well applicable to DIETZ's data although it is not perfect.

3)   Liver lipase

(i)   Data obtained by HERZOG[32] in the decomposition of ethyl acetate.   To HERZOG's data T. N. N. I and II are almost equal in applicability as given in TABLE XLV.   The best equation is to be determined by the examination of data of wide range of decomposition.

(ii)   Data obtained by KASTLE, JOHNSTON and ELVOLVE[40] in the decomposition of ethyl butyrate.   They considered that their data followed the $1\frac{1}{2}$ molecular equation.   Their calculated result is given in TABLE XLVI where the data of the last column were found by the present author.   He applied T. N. N. I and II to the data as given in TABLES XLVII and XLVIII.   The experimental curve seems to be not smooth and the data are not adequate for examining the applicability of equations.   However T. N. N. II is considered to be satisfactory fundamentally.

4)   Lipase of fatty tissue

Data obtained by EULER[20] in the decomposition of ethyl butyrate as given in TABLE XLIX.   To the data T. N. N. I seems satisfactory as shown in TABLE L.

5)   Lipase of blood

(i)   Data obtained by RONA and EBSEN.[63]   The condition of experiment is as follows :   60 cc. of saturated tributyrin solution + 5 cc. of H_2O + 2 cc. of phosphate mixture + 1~2 cc. of rabbit blood of 1/10 concentration ; determined by a staragmometer at 18°C.   The monomolecular equation was applied by the authors.   The present author applied T. N. N. I and II to their data taking the value of $a-x$ at $t=0$ as the value of a in the equations.   T. N. N. I seems to be well applicable as seen in TABLES LI and LII.

(ii)   Data obtained by PIGHINI[57] in the decomposition of monobutyrin by serum lipase of guinea pig.   The best applicable equation cannot be determined as between T. N. N. I and II.

The author applied T. N. N. I and II to many published data obtained with various lipases.   The best applicable equation has been determined for each lipase with few exceptions as given in TABLE LIII.

Chlorophyllase

To the data obtained by WILLSTÄTTER and STOLL,[82] T. N. N. II is satisfactory as shown in TABLE LIV.

Lichenase

(i)   Data obtained by KARRER, JOOS and STAUB.[39]   The condition was as follows: 0.4 g lichenin in 250 cc. of phosphate mixture; P_H value 5.25; 36°C.   Two results followed T. N. N. II as given in TABLES LV and LVI.

(ii)   Data obtained by PRINGSHEIM and SEIFERT.[61]   The third datum of this is out of a smooth curve as shown in FIG. I.   Therefore the equations were applied to the result omitting the datum.   T. N. N. II is satisfactory as given in TABLE LVII.

Inulase

(i)   Data obtained by BOSELLI[11] under such conditions as 20 cc. of 4% inulin solution + 10 cc. of buffer solution of P_H value 3.8 + 10 cc. of H_2O + 40 cc. of enzyme solution; 37°C.   In TABLE LVIII x is the quantity of fructose in mg and a the maximum hydrolysable quantity. BOSELLI applied the monomolecular law which is distinctly not perfect. T. N. N. equations were applied to the data, taking 222 as the maximum quantity of decomposition.   As seen in TABLE LIX, T. N. N. II seemed better but as the differences for the 7th datum were specially large in both results the equations are again applied omitting this datum as seen in TABLE LX, where T. N. N. I is better applicable than II and the result of the application of T. N. N. II in TABLE LVIII is considered to be not true.

(ii)   A result obtained by PRINGSHEIM and PEREWOSKY[60] under such conditions as 20 cc. of 4% inulin solution + 10 cc. of buffer solution of P_H value 3.8 + 40 cc. of enzyme solution A. Similar to the previous example, the applicability of T. N. N. II is not true.   As seen in TABLE LXI, T. N. N. I is better than II although the applicability is not perfect.

For the data obtained with enzyme solution B, T. N. N. I is also better.

Inulase seems to follow T. N. N. I.

Cellobiase

Data obtained by PRINGSHEIM and LEIBOWITZ[59] under such conditions as, P_H value 5; 37°C.   This result follows T. N. N. II as given in TABLE LXII.   To another result of the same authors the applicability of both T. N. N. I and II is low, but as the data of the result are only 3 further examination cannot be done.

Amylase

1) Taka-diastase

Data obtained by PHILOCHE.[56] For the result obtained with 1% starch, T. N. N. I is better applicable than II, as seen in TABLE LXIII. For the result obtained with 2% starch the better applicability cannot be determined certainly between T. N. N. I and II, but the former seems to be better, as seen in TABLES LXIV and LXV. For the result obtained with 3% starch T. N. N. I seems also better than II, as seen in TABLE LXVI.

From the examination above given three results obtained by PHILOCHE with Taka-diastase can be recognized to follow T. N. N. I.

2) Malt-diastase

(i) Data obtained by HENRI[31] with 3% starch solution at 25C. T. N. N. I seems to be satisfactory, as seen in TABLE LXVII.

(ii) Data obtained by BROWN and GLENDINNING.[13] The authors applied the equation $K = \dfrac{1}{t} \, ln \, \dfrac{a+x}{a-x}$ to their data. It seems very satisfactory but the applicability cannot be determined only from ascertaining the uniformity of the values of the constant. The experimental result seems to follow T. N. N. I as seen in TABLE LXVIII, although it is not perfect.

(iii) Data obtained by SHERMAN and WALKER.[68] The authors applied the monomolecular law to their data, taking the value of the quantity of glucose equivalent to the quantity of starch taken as the value of a in the equation. The applicability is very low. The present author considers that such a method of application is not proper. In the decomposition by amylase there is a certain maximum hydrolysable quantity according to the experimental condition, the value of which must be taken as the value of a. The value of that maximum quantity is uncertain in their report. Therefore the best applicable equation cannot be determined for their results.

3) Pancreas amylase

Data obtained by HENRI.[31] He applied the monomolecular equation. T. N. N. I is almost perfect as seen in TABLE LXIX. As the value of k' is near 1 the monomolecular equation is equally good.

4) Liver amylase

. Data obtained by HOLMBERGH[36] with starch and glycogen. They follow T. N. N. II as seen in TABLE LXX.

The author has examined the applicability of equations to published data obtained with amylase. The best equation for each amylase is shown in the recapitulation in TABLE LXXI.

Maltase

(i) A result obtained by WILLSTÄTTER, OPPENHEIMER and STEIBELT[80] in the decomposition of maltase with the extract of yeast of Löwenbräu. The applicability of T. N. N. I is perfect, as given in TABLE LXXII.

(ii) Data obtained by PHILOCHE[56] in the decomposition of maltose with Taka-diastase. He applied the equation $K = \dfrac{a}{t}\left(\dfrac{2x}{a} + ln\dfrac{a}{a-x}\right)$ to his data. The equation was considered better than the monomolecular equation. The values of K are comparatively near one another and the equation seems to be satisfactory, but the point is uncertain. T. N. N. I and II equations were applied as given in TABLE LXXIII. The equations were applied further to data without 4th and 6th data or without 3rd and 5th data but the better applicable equation could not be determined. The two equations do not seem to be satisfactory.

(iii) Data obtained by WILLSTÄTTER and STEIBELT[81] in the decomposition of a-methyl glucoside. The results of application of T. N. N. I and II are given in TABLE LXXIV. T. N. N. II is almost satisfactory.

(iv) Data obtained by WILLSTÄTTER and OPPENHEIMER[78] in the decomposition of a-ethyl glucoside with the yeast of Löwenbräu. As seen in TABLE LXXV, T. N. N. I is satisfactory.

(v) Data obtained by WILLSTÄTTER and OPPENHEIMER in the decomposition of a-phenyl glucoside. As given in TABLE LXXVI, T.N. N. II is surely better than I.

The best applicable equations for data obtained with maltose from various sources are summarized in TABLE LXXVII.

Emulsin

(i) Data obtained by HERZOG[34] in the docomposition of salicin. Herzog considered that the equation $K_4 = K_2\left(\dfrac{K_2}{K_1} - a\right)$ held true where

$K_2.a = K_1.0.6$ and K_1 is the constant of monomolecular law. T. N. N. I is satisfactory as seen in Table LXXVIII.

(ii) Data obtained by Willstätter and Oppenheimer[78] in the decomposition of arbutin. Cf. Table LXXIX.

(iii) A result obtained by Willstätter and Openheimer[78] in the decomposition of β-methyl glucoside. Cf. Table LXXX.

(iv) Data obtained by Willstätter and Oppenheimer[78] in the decomposition of β-phenyl glucoside. Cf. Table LXXXI.

(v) Data obtained by Willstätter and Oppenheimer[78] in the decomposition of helicin. Cf. Table LXXXII.

(vi) Data obtained by Willstätter and Csányi[75] in the decomposition of raffinose. Cf. Table LXXXIII.

For the data given under (ii)—(vi) T. N. N. I is satisfactory. As the value of k' is near 1 in all cases the monomolecular law shows almost the same applicability.

As examined above T. N. N. I is satisfactory for emulsin.

Invertase

(i) Data obtained by Michaelis and Menten[45] follows T. N. N. I as given in Table VI.

(ii) Data obtained by Nelson and Hitchcock.[51] They obtained an experimental equation,

$$t = 222.9 \log \frac{100}{100\text{-}p} + 0.5890\,p - 0.001974\,p^2 - 0.00002043\,p^3,$$

where p denotes the percentage of substrate decomposed. T. N. N. I was applied as given in Table LXXXIV. The equation is not quite satisfactory for Nelson and Hitchcock's result, but it can be said to be applicable to a certain extent.

(iii) Data obtained by Euler and Kullberg.[24] They obtained an enzyme solution by treating fresh yeast with 0.67% KH_2PO_4 solution. To their data T. N. N. I is well applicable as seen in Table LXXXV.

Raffinase

(i) Data obtained by Willsttäter and Kuhn.[76] The decomposition was considered to follow the monomolecular law. T. N. N. I is almost satisfactory as seen in Table LXXXVI.

(ii) Data obtained by Colin and Chaudan.[14] T. N. N. I is almost satisfactory as seen in Table LXXXVII.

Lactase

1) Data obtained by WILLSTÄTTER and OPPENHEIMER.[78] They decomposed lactose of 5% solution with the neutral extract of saccharomyces fragilis. P_H value, 7.0; decomposed at 30°C. T. N. N. I is satisfactory as seen in TABLE LXXXVIII.

2) Data obtained by ARMSTRONG.[3]

(i) He applied the SCHÜTZ law. T. N. N. I is not satisfactory for all the data but it is satisfactory for the data without the last datum as given in TABLE LXXXIX.

(ii) Data obtained by using a solution of 100 cc. which contained 0.4 g of emulsin. The monomolecular law was applied. The value of the constant fell with the progress of decomposition. T. N. N. I is satisfactory as seen in TABLE XC.

(iii) Data obtained by using a solution of 100 cc. which contained 0.1 g of emulsin. T. N. N. I is much better than the monomolecular law as seen in TABLE XCI.

3) Data obtained by WILLSTÄTTER and CSÁNYI.[75] The conditions were :—20 cc. of 0.7% lactose + 50 mg of emulsin ; at the optimum P_H value of 4.4 ; decomposed at 30°C. T. N. N. I is almost satisfactory and is better than II as seen in TABLE XCII.

Mannase

Data obtained by MIYAKE[46] with mannase of aspergillus niger. T. N. N. I is always satisfactory as seen in TABLE XCIII.

Tannase

FREUDENBERG[27] applied the monomolecular law to his data obtained in the decomposition by tannase. The value of K decreased with the increase of the decomposition time, which he attributed to the influence of the increasing quantity of acid. Most of the results of FREUDENBERG are not adequate to examine the applicability of equations. To some of his results T. N. N. I and II were applied. T. N. N. I is satisfactory within a certain degree of decomposition as seen in TABLE XCIV.

Pepsin

1) Data obtained by NAKAMURA[50] with proteins of barleys. T. N. N. II is satisfactory.

2) Data obtained by NAKAJIMA[49] with glycinin. T. N. N. II is satisfactory.

3) Data obtained by MATSUYAMA and NAKAMURA[43] in the decomposition of egg-white. T. N. N. II is satisfactory as seen in TABLE XCV.

4) Data obtained by RONA and KLEINMANN[64] in the decomposition of serum albumin at 40°C. For their many results the author examined the applicability of T. N. N. I and II. Some of the results are shown in TABLE XCVI. According to the group of data, either T. N. N. I or T. N. N. II is apparently more applicable than the other. As seen in the table, T. N. N. I is sometimes better than II, but II is considered to be truly applicable.

The data obtained in the decomposition by pepsin have been proved to follow T. N. N. II.

Trypsin

1) Data obtained by NAKAJIMA in the decomposition of normal and denatured glycinins. T. N. N. I was always better applicable than II.[49]

2) Data obtained by RONA and KLEINMANN.[64] They gave about a hundred results in their paper, from which several were taken at random and T. N. N. equations were applied to them. Some of the results are given in TABLE XCVII. The result given in TABLE XCVII (v), where T. N. N. II is better than I, is exceptional. But the difference of applicability is very small. T. N. N. II seems to have shown an apparently good application.

3) A result obtained by BAYLISS[10] in the decomposition of sodium caseinate. ARRHENIUS applied the equation, $a(\log a - \log x) - (a - x) = Kt$, to BAYLISS's data as shown in TABLE XCVIII in which a denotes the degree of conductivity. As the value of a in applying T. N. N. equations is uncertain, they cannot be applied.

Papain

Data obtained by NAKAJIMA in the decomposition of the normal and denatured glycinins. T. N. N. II was satisfactory.[49]

Protease

1) Data obtained by OSHIMA[55] with yeast protease. He applied the SCHÜTZ law to his data and considered it to be more satisfactory than the monomolecular law. For the data obtained with peptone T. N. N. II is satisfactory, while for the result obtained with casein T. N. N. I is satisfactory, as seen in TABLE XCIX.

2) Data obtained by WEIS[73] in the decomposition of glutin with protease of germinating barley. T. N. N. II is satisfactory as seen in TABLE C. But as the range of decomposition is very narrow further examination is needed.

3) Data obtained by DERNBY[15] in the auto-digestion of yeast with its endotryptase. DERNBY compared the applicabilities of the SCHÜTZ law, ARRHENIUS's equation, $K_A = \dfrac{1}{t}\ a \cdot ln\ \dfrac{a}{a-x} - x$, HENRI's equation,

$K_H = \dfrac{1}{t}\ ln\ \dfrac{a+x}{a-x}$ and his own equation, $K_D = \dfrac{1}{\sqrt{t}}\ ln\ \dfrac{a+x}{a-x}$. The last

equation was considered the best. As the value of the experimental result for time 0 was 8, the value 100−8, and the value of $x−8$ must be taken respectively as the value of a and the value of x in applying such equations as above shown. DERNBY's method of application of equations is, in the present author's opinion quite mistaken. In most cases T. N. N. I is better than II as seen in TABLE CI and CII.

Peptidase

1) Data obtained by ABDERHALDEN and FODOR[1] in the decomposition of glycyl-l-leucin by yeast extract

The results of application of T. N. N. I and II, taking 0.0625 as the value of a, are given in TABLE CIII, where the best applicable equation cannot be determined. However, as the value of the probable error even for the equation of lower applicability is small for each experimental result, T. N. N. I or II only is considered to be fundamentally applicable for ABDERHALDEN and FODOR's data.

2) Data obtained by EULER[22] in the decomposition of glycylglycin with erepsin

As in the previous case, the best applicable equation cannot be determined, as seen in TABLE CIV.

Arginase

1) Data obtained by Gross[29] follows T. N. N. II.   (Cf. Table I.)
2) Data obtained by Edlbacher and Simons[18]

The results of application of T. N. N. equations are shown in Table CV, where T. N. N. II is always better applicable than I, though it is not perfect.

Urease

Armstrong[4] reported that the decomposition by urease did not follow the monomolecular equation.   Van Slyke and Cullen[72] proposed an equation, $Et = \dfrac{1}{c} \log \dfrac{a}{a-x} + \dfrac{x}{d}$. Barendrecht's empirical equation is $m = \dfrac{1}{t}[0.0176 \log \dfrac{1}{1-y} + 0.02y]$ which is included in Van Slyke's equation.   Lövgren[41] examined the equation of Van Slyke and concluded that it was not satisfactory for their special data.

1) Data obtained by Barendrecht[9]

A Barendrecht's result given in Table CXVI has many terms and plots a very smooth curve and the range of the decomposition is wide.   Therefore it seems to be satisfactory for exemining the applicability of an equation.   For the result, the applicability of T. N. N. II and III is not satisfactory.   T. N. N. I is much better than T. N. N. II or III although it is not very satisfactory.   The experimental result is very peculiar, in spite of the very smooth curve of it, for the quantity obtained in the decomposition for 5th 20 mins. is much larger than that for 4th 20 mins., which shows that his result is not accurate.   The applicability of T. N. N. I to the data without the 4th and the last two data is little better than that to the whole data as shown in Table CXVI.   T. N. N. I seems to be fundamentally applicable.

2) Data obtained by Wester[74]

The data of each group of Wester's results are too few to determine the applicability of an equation but T. N. N. equations were applied for trial.   T. N. N. I is better than II as seen in Table CVII.

As examined above T. N. N. I seems to be satisfactory for data obtained with urease.

Asparaginase

Data obtained by Geddes and Hunter[28] with yeast asparaginase.

T. N. N. I seems better applicable than II within 50% decomposition as seen in TABLE CVIII.

Phosphatase

1) Data obtained by EULER and KULLBERG[24]

Their experimental conditions were as follows:

The solution (of 300 cc. of 23% sucrose + 50 g of dry yeast) was mixed for $3\frac{1}{2}$ hrs.; 40 cc. of filtrate + 40 cc. of 2% neutral NaH_2PO_4 solution.

The experimental terms are few. T. N. N. II is better than I or the monomolecular law, as shown in TABLE CIX.

A similar result of application was obtained for other of their data obtained with glucose instead of sucrose.

2) Data obtained by DJENAB and NEUBERG[17]

Their experimental conditions were as follows:—

20 g of Na-saccharophosphate + 20 g of yeast + 400 cc. of H_2O + 20 cc. of toluene; decomposed at 30°C.; P_2O_5 was determined with magnesium mixture. T. N. N. II is better applicable than I though it is not satisfactory as seen in TABLE CX.

3) Data obtained by Nemec[52]

Glycerophosphate was decomposed by phosphatase of yellow soy bean under such conditions as 20 g of seed in 40 cc. of 1% sodium glycerophosphate + 10 cc. of toluene. NEMEC applied the SCHÜTZ law to his data and considered it to be satisfactory for the data obtained at the beginning of decomposition. T. N. N. II is better than I as seen in TABLE CXI.

Mutase

EULER and BRUNIUS obtained data with mutase.[23]

(i) Data obtained in the absence of co-enzyme. No marked difference of applicability can be seen between T. N. N. I and II, as shown in TABLE CXII (i).

(ii) Data obtained in the presence of co-enzyme. T. N. N. I is better applicable than II as seen in TABLE CXII (ii).

(iii). Enzyme solution was before treated with acetic acid. Not all the data shown in TABLE CXII (iii) are proper to apply the equation to, which is clearly shown by plotting the data. T. N. N. I seems better than II for the data without the 3rd datum as seen in the table.

To determine the best equation for data obtained with mutase, further examination is needed. But T. N. N. I seems to be satisfactory.

Peroxidase

1) Data obtained by Willstätter and Stoll[82] with vegetable peroxidase

Pyrogallol was decomposed to purpurogallic acid. The application of the monomolecular law to the data was supported as true by the authors. T. N. N. I is better than II as seen in Table CXIII.

2) Data obtained by Bansi[8] with extract of horse radish

The bimolecular equation was taken to be well applicable. The values of probable error for both T. N. N. I and II are large and a satisfactory equation cannot be determined, as shown in Table CXIV.

Catalase

1) Yeast catalse

Data obtained by Issajew[37] have been examined as follows:
(i) T. N. N. I is satisfactory as already given in Table IX.
(ii) T. N. N. I is satisfactory as already given in Table X.

2) Catalase of shaggy boletus

Data obtained by Euler[20]
(i) Data obtained with 3 cc. of enzyme solution. T. N. N. II is satisfactory as already given in Table XII.
(ii) Data obtained with 4 cc. of enzyme solution. T. N. N. II is satisfactory as shown in Table CXV (i).
(iii) Data obtained with 5 cc. of enzyme solution. The results of application of T. N. N. II are shown in Table CXV (ii). T. N. N. II is satisfactory.

As examined above T. N. N. II is always satisfactory for Euler's data.

3) Liver catalse

Data obtained by Rona and Damboviceanu[62]
(i) Data obtained with the water solution of enzyme. The $1\frac{1}{2}$ molecular equation was applied by the authors. T. N. N. II is satis-

factory as shown in TABLES XXVIII and XXIX.

(ii) Data obtained with the enzyme solution of 5 cc. of 0.154 mol. NaCl. RONA considered that the decomposition was slow because of the retarding action caused by NaCl, as if only a little quantity of enzyme had been used, and he considered that the bimolecular equation was satisfactory, as shown in TABLE CXVI. As often shown, the value of K of this equation is apparently uniform, but the proof is very incomplete. Although T. N. N. II is better than I for all the data, the probable error is not small. As the point for the third term seems to be out of a smooth curve and the number of experimental terms are few, the data themselves are not proper for examining the applicability of equations.

(iii) Data obtained with 5 cc. of 0.15 mol. of NaCl, 0.025 mol. of KCl, 0.0018 mol. of KCl, 0.0018 mol. of $CaCl_2$ and 0.0011 mol. of $NaHCO_3$. The retarding action of NaCl was considered to be prevented by the presence of $NaHCO_3$ and the decomposition was considered to follow the $1\frac{1}{2}$ molecular equation. T. N. N. II is very satisfactory as shown in TABLE CXVII.

Two of the three results above taken follow certainly T. N. N. II.

4) Blood catalase

(i) Data obtained by SENTER.[66] T. N. N. I is satisfactory as shown in TABLE CXVIII and as the value of k' is always near 1 the monomolecular equation is also about equally well applicable.

(ii) Data obtained by YAMAZAKI.[85] YAMAZAKI's study has been previously introduced in this paper. In the following example E_0 denotes the quantity of enzyme and C_0 the quantity of substrate taken. T. N. N. I is always satisfactory, as shown in TABLE CXIX. The value of k' of YAMAZAKI's equation decreases with the progress of decomposition and the result of the application of his equation is, more or less, unsatisfactory, which YAMAZAKI himself recognized in his report.

(iii) Data obtained by MAXIMOWITSCH and AWTONOMOVA.[44] Their theory and equation has been already introduced in this paper. The range of decomposition in their experimental data is very narrow for examining the applicability of equations and the number of terms for calculating the mean value of D in MAXIMOWITSCH's equation is quite uncertain for a certain number of experimental terms. These have already been pointed out by the present author. For trials T. N. N. was applied to

their data to examine the applicability.   The results obtained in ap-
plying T. N. N. I are given in Table CXX.

5)   Catalase of soy bean

Results obtained by Yamazaki.   The meaning of E_0 and C_0 was
shown on page 158.   The sign of the difference obtained by Yamazaki
occurs not irregularly.   Most of the values of differences, $\mathit{\Delta}$, in one
calculated result are positive or negative, which itself shows the imper-
fection of Yamazaki's equation.   T. N. N. I is not always satisfactory
but it seems to be applicable.

From the examination of the equations above shown it is seen that
the highest applicable equation for catalase of yeast and blood is T.
N. N. I and that for catalase of liver and shaggy boletus T. N. N. II.

Zymase

1)   Data obtained by Aberson[2]

Aberson considered the equation $\dfrac{1}{t}\log\dfrac{a+x}{a-x}=K$ to be satisfactory

for his data.   The result of application of T. N. N. I is shown in Table
CXXI.   The better equation of these two cannot be here determined.

2)   Data obtained by Euler[21]

T. N. N. I seems to be satisfactory as shown in Table CXXII.

3)   Data obtained by Herzog[32]

Herzog applied $\dfrac{1}{t}\log\dfrac{a}{a-x}=K_1$ and Aberson's equation, $\dfrac{1}{t}\log$

$\dfrac{a+x}{a-x}=K_A$ to his data.   To compare the applicability of these equations

with that of T. N. N. I, the present author applied $\dfrac{1}{t^{k'}}\log\dfrac{a+x}{a-x}=K$

instead of $\dfrac{1}{t}\dfrac{a+x}{a-x}=K_A$ and T. N. N. I.   The probable error for the

latter equation is always smaller than that of the former as seen in
Table CXXIII.

5.   Recapitulation of results of application of
T. N. N. equations

From the results of application of T. N. N. I and II to the author's
data and to the principal published data of as many reports as he could
find, the kind of enzyme and substrate, and the best applicable equa-

tion are extracted and tabulated in TABLE CXXIV. For some kinds of enzymes further examination is necessary or some corrections may be possible in the determination of applicable equations because the data used for examination are not all adequate.

Decomposition, taking the relative quantity of enzyme as a variable

In this part, equations applicable to data obtained in decomposition taking the relative quantity of enzyme as a variable will be studied.

1. Examination of the equation $\dfrac{x}{E} = K$

The principal equations expressing the rate of decomposition taking the relative quantity of enzyme as a variable have once been reviewed in the author's report, " Refutation of the SCHÜTZ law and its analogous equations in the kinetics of enzymes.[48]"   In this report the SCHÜTZ law $\dfrac{x}{\sqrt{E}} = K$ was accepted by the present author for data obtained only with dilute pepsin. The reexamination of this equation will be made in the next paragraph. The cases of application of other equations have been few, except the equation $\dfrac{x}{E} = K$ (or $\dfrac{x}{e} = K$) which has been often applied and considered to be well applicable. Therefore only this equation will be hereafter examined. Although it is better than any other equation it is only comparatively so. To the writer the equation is quite unsatisfactory, which can easily be known if the items given under paragraph 3 on page 161 are considered. The curves of experimental results obtained in decomposition taking the relative quantity of enzymes as a variable must pass through zero point and $x \rightarrow a$ if $\lim_{E \to \infty}$. The nature of the curve is quite the same as that obtained in decomposition taking time as a variable. Therefore the writer is going to modify the T. N. N. equations. Substitute $E^{k'}$ for $t^{k'}$ in T. N. N. I and II, and the following equations are obtained :

$$\frac{1}{E^{k'}} \log \frac{a}{a-x} = K,$$

$$\frac{1}{E^{k'}} \frac{x}{a(a-x)} = K.$$

In these equations E denotes the quantity of enzyme, x the quantity

of substrate decomposed and a the quantity of substrate taken or the quantity in ultimate decomposition. These equations are mathematically quite the same as the T. N. N. equations respectively. For the sake of convenience the equations above given will be denoted by T. N. N. (E) I and T. N. N. (E) II or merely (E) I and (E) II. These are usually satisfactory for experimental data as will be given later. In the results of application of the equation $\frac{x}{E} = K$ in original papers, only the values of K are usually given. In the following examination the author will give the calculated value and the difference between the calculated and experimental values of the equation to compare the applicability with that of another equation.

<div align="center">Lipase</div>

Cartor beau lipase

(i) Data obtained by Nicloux.[53] (E) I is satisfactory while the value of the total differences for the equation $\frac{x}{E} = K$ is due almost to negative quantity, and the equation is not satisfactory as seen in Table CXXV.

(ii) Data obtained by Jalander[38] with cotton seed oil at 22°C. Within 52.77–4.64 percent decomposition the same defects of the equation $\frac{x}{E} = K$ as seen for the previous example are observed. The calculated results are given in Table CXXVI.

<div align="center">Lactase</div>

Data obtained by Armstrong[3]

The number of experimental data obtained by Armstrong are few, but for trial the comparison of the applicabilities of equations is made with calculated results as given in Table CXXVII. No marked difference of applicability between (E) I and (E) II can be observed but the defect of $\frac{x}{E} = K$ is clearly seen.

The defects of $\frac{x}{E} = K$ as shown for the above examples have been the same for any other examples. On the other hand T. N. N. (E) equations seem always to be satisfactory.

2. Reexamination of the Schütz law for data obtained with dilute peptic solution

The SCHÜTZ law, $\dfrac{x}{\sqrt{E}} = K$, has once been accepted by the present author only for data obtained with dilute pepsin. But as will be later shown T. N. N. (E) I is always well applicable to data obtained with either dilute or concentrated pepsin. It is necessary to compare the applicabilities of $\dfrac{x}{\sqrt{E}} = K$ and T. N. N. (E) I. The concentration of pepsin in J. SCHÜTZ's idea for the E. SCHÜTZ law does not mean the concentration of numerical expression. Therefore the present author will reexamine the law with examples for which it was accepted to be well applicable by preceding investigators. The data of a result which have the widest range of x and E in the original paper of E. SCHÜTZ are first taken. As seen in TABLE CXXVIII each difference is comparatively small and the total positive quantity is about equal to the negative, though the distribution of the sign (positive or negative) is not satisfactory. But the present author found that the values of K calculated by SCHÜTZ were mistaken. From the values of E and x the values of K in correction and the difference between the experimental and calculated values of x for different ranges of decomposition are found and shown in TABLE CXXIX. In this table the positive quantity is much larger than the negative and the distribution of both signs of difference is also not satisfactory. The point for the first datum is surely on a smooth experimental curve and if the theory of J. SCHÜTZ for the dilute pepsin that E. SCHÜTZ's law is true for data obtained with dilute peptic solution is true, the datum of the smaller percentage is the more important for maintaining the high applicability of the law. Yet the result of application obtained by omitting the first datum is apparently more satisfactory than that for all the data. E. SCHÜTZ showed the total values of the experimental and calculated values respectively in each result of application. But such a comparison has no meaning or reason in evaluating his equation. As the maximum hydrolyzable quantity of the substrate taken is uncertain, T. N. N. (E) equations cannot be applied to his data. The other two examples given in SCHÜTZ's original paper are shown in TABLE CXXX. The first one is of data of a narrow range of decomposition and the second is of very few data. To examine the applicability of an equation neither of

the two results is adequate (cf. paragraph 3 on page 158). From the above examination the SCHÜTZ law $\dfrac{x}{\sqrt{E}} = K$ seems not to be satisfactory even for his own data.

ARRHENIUS applied his equation, $F.K_A = \dfrac{a}{t}\ln\dfrac{a}{a-x} - \dfrac{x}{t}$, to one of J. SCHÜTZ's results. He wrote that it was better applicable than $\dfrac{x}{\sqrt{E}} = K$. The result of application of (E) I is given for comparison in TABLE CXXXI. To ascertain whether the applicability of ARRHENIUS's equation is true or apparent, much more examination with many data is necessary. There can scarcely be found any available data to which T. N. N. (E) I may be applied to compare the applicability with that of $\dfrac{x}{\sqrt{E}} = K$, because the value of a is uncertain. Many experimental data and the results of application of $\dfrac{x}{\sqrt{E}} = K$ are given in SCHÜTZ and HUPPERT's paper. For these examples the same defects of $\dfrac{x}{\sqrt{E}} = K$ as already pointed out by the present author can be shown. Their results are not suitable for studying the applicability of equations. As the value of a is uncertain or the terms of the experimental result are few, T. N. N. (E) cannot be applied to their data. The author accepted previously J. SCHÜTZ's theoretical explanation of the E. SCHÜTZ law. However his theory was deduced only from the inference and the experimental result is never satisfied by it. Now the present author rejects the SCHÜTZ law $\dfrac{x}{\sqrt{E}} = K$ for data obtained even with dilute pepsin.

3. Results of application of T. N. N. (E) equations to published data

The author applied T. N. N. (E) I and II to his data and to data obtained by the principal preceding investigators. He utilized as many reports as he could. The results will be given below.

Lipase

1) Castor bean lipase

(i) Data obtained by NAKAJIMA with soy bean oil. (E) I is satisfactory.[49]

(ii)   Data obtained by NICLOUX[53] with olive oil. (E) I is satisfactory as shown on page 180.

(iii)   Data obtained by JALANDER[38] with cotton seed oil. (E) I is satisfactory as shown on page 180.

2) Papain lipase

(i)   Data obtained by NAKAJIMA.   T. N. N. (E) II is satisfactory.[49]

(ii)   Data obtained by SANDBERG and BRAND.[65]   T. N. N. (E) II seems to be satisfactory as seen in TABLE CXXXII.

3) Pancreas lipase

(i)   The applicabily of T. N. N. (E) equations was examined for a group of data obtained by ENGEL with egg-yolk and for that obtained by WILLSTÄTTER, WALDSCHMIDT-LEITZ and MEMMEN.   The best applicable equation was not constant to the whole data and limitted data of both authors.

(ii)   Data obtained by WILLSTÄTTER, WALDSCHMIDT-LEITZ and MEMMEN with olive oil.   In this case the best equation cannot be determined as between (E) I and II as seen in TABLE CXXXIII.

For data obtained by pancrease lipase both (E) I and II are almost satisfactory but the better equation cannot be here determined as between (E) I and II.

4) Liver lipase

(i)   Data obtained by KASTLE and LOEVENHART[41] in the decomposition of ethyl butyrate by swine liver enzyme. (E) I is satisfactory as seen in TABLE CXXXIV.

(ii)   Data obtained by SCHMIDT[67] with morphine glycollic acid ester. (E) I is satisfactory as seen in TABLE CXXXV.

As above examined, to the data of the two results (E) I is well applicable.

5) Data obtained by STADE[69] in the decomposition of egg-yolk

SATADE applied the equation $x = \sqrt{F}. t$ where F denoted the quantity of enzyme, t decomposition-time and x the quantity of substrate decomposed.   The present author calculated the differences between the experimental and calculated values for his equation.   All the differences are negative quantity as shown in TABLE CXXXVI, which shows the defect of the epuation.   Neither T. N. N. I nor II is satisfactory, nor is the

better equation constant. This is because the experimental result may not have been accurate or the maximum hydrolyzable quantity may not have been 100.

Amylase

Data obtained by OSHIMA[55] in the decomposition of soluble starch by enzyme solution prepared from *Koji-kin*. In applying T. N. N. (E) equations the value of glucose equivalent to the quantity of substrate was taken as the value of a.

(i) Data obtained in the decomposition for 20 mins.

T. N. N. (E) I and II are quite unsatisfactory as seen in TABLE CXXXVII. OSHIMA made it clear that the maximum hydrolyzable quantity obtained by the enzyme was far less than the quantity of the equivalent glucose. In a test 120 mg of glucose and not more were obtained with 2% enzyme solution. For trial 120 is taken as the value of a, yet the T. N. N. (E) equations are quite unsatisfactory as seen in TABLE CLXXXVIII. T. N. N. (E) III is also not satisfactory.

(ii) Data obtained in the decomposition for 1 hour

In the results of application taking 154 or 120 as the value of a, T. N. N. (E) I and II are also unsatisfactory as seen in TABLE CXXXIX.

For the data of other results T. N. N. (E) I, II and III were also unsatisfactory. In the decomposition by amylase there can be no satisfactory equation for the data obtained by taking the relative quantity of enzyme as a variable, even though they are plotted on a smooth curve, because the maximum hydrolyzable quantity varies with the quantity of the enzyme, i. e. the value of a is not constant. (cf. page 162, (iv)).

Lichenase

Data obtained by PRINGSHEIM and BAUR[58]

(i) Data obtained with purified lichenin. T. N. N. (E) II is satisfactory as shown in TABLE CXL.

(ii) Data obtained with ordinary lichenin. One of the results of application is shown in TABLE CXLI, where (E) II is better than (E) I though it is not at all satisfactory.

Tannase

Data obtained by FREUDENBERG and VOLLBRECHT[27] at 23°C. for 24 hours decomposition. The results of application of T.N.N. (E) II for all the data or for data of E: 0.01~0.08 show that the equation is

better than (E) I, but as only the 4th datum is plotted out of a smooth curve the author compares the two equations for data, omitting that datum where (E) I is surely better than (E) II as shown in TABLE CXLII.

Lactase

Data obtained by ARMSTRONG. The better equation could not be determined, as already given in TABLE CXXVII.

Pepsin

1.   Data obtained by NAKAJIMA in the decomposition of normal and denatured glycinis. (E) I was satisfactory.[49]

2.   Data obtained by MATSUYAMA and NAKAMURA[43] in the decomposition of egg-white in the solution of P_H value 1.75 at 37°C. by Merck's pepsin of two kinds, A and B. T. N. N. (E) I was always satisfactory. Some of the calculated results are given in TABLE CXLIII.

Pancreatin

Data obtained by NAKAJIMA in the decomposition of normal and denatured glycinins. (E) I was satisfactory.[49]

Protease

(i)   Data obtained by OSHIMA[55] in the decomposition of WITTE's peptone with aspergillus protease. T. N. N. II is better than I as seen in TABLE CXLIV.

(ii)   Data obtained by OSHIMA[55] in the decomposition of casein with aspergillus protease. The T. N. N. (E) II seems to be satisfactory.

Polypeptidase

Data obtained by GROSSMANN and DYCKERHOFF[30] in the decomposition of d-l-leucyl-glycyl-glycin. (E) I is better applicable than II as seen in TABLE CXLV.

Asparaginase

Data obtained by GEDDES and HUNTER[28] with asparaginase of yeast. (E) I seems to be applicable to their data as seen in TABLE CXLVI.

Emulsin

Data obtained by TAMMANN[70] in the decomposition of salicin.

(i) Salicin of 3,007% solution was decomposed for 24 hours at 0°C. More than 66% of salicin remained undecomposed even though more of the enzyme was used. 66 was taken as the value of a in applying (E) I and II. The better applicable equation cannot be determined as seen in TABLE CXLVII.

(ii) Salicin of 3.3% solution was decomposed for 12 hours at 28°C. To the data (E) I seems to be applicable as seen in TABLE CXLVIII.

Amygdalase

Data obtained by AULD.[5] Similarly to T. N. N. I and II for data obtained taking time as a variable, neither (E) I nor II is well applicable, as seen in TABLE CXLIX.

3. Recapitulation of results of application of T.N.N. (E) equations

As examined above T. N. N. (E) equations are not well applicable to data obtained with amylase, which can well be explained. To data obtained by amygdalse the equations are also not well applicable. The applicable equations to data obtained with other various enzymes could be determined the results of which are summarized in TABLE CL.

Decomposition taking the quantity of substrate as a variable

For data obtained in the decomposition of substrates with various enzymes taking the length of time or the quantity of enzyme as a variable, the author has determined the best applicable equation, according to the kind of the enzyme or the kind of enzyme and substrate, with few exceptions. For data obtained in decomposition taking the quantity of substrate as a variable, not many equations have been proposed. All of them are very incomplete, similarly to various equations for data obtained in the previous two cases. In the study of soy bean proteins and oil the author decomposed the proteins with pepsin, pancreatin and papain, and oil with castor bean lipase and papain, taking the quantity of substrate as a variable. He endeavoured to find applicable equations to data thus obtained. He modified the T. N. N. equations. In the decomposition in this study, contrary to the decomposition in the previous two cases, the quantity of substrate decomposed

decreases with the increase of the quantity of substrate. Let S denote the quantity of substrate and x the quantity of substrate decomposed in percentage. In applying the T. N. N. equations, $a-x$ was used instead of x, S instead of t in T. N. N. I and II and the following equations were obtained:

$$\frac{1}{S^{k'}} \log \frac{a}{x} = K, \qquad \text{(from T. N. N. I)}$$

$$\frac{1}{S^{k'}} \frac{a-x}{a \cdot x} = K. \qquad \text{(from T. N. N. II)}$$

For the the sake of convenience the author named these equations T. N. N. (S) I and T. N. N. (S) II or briefly (S) I and (S) II respectively.

1. Results of application of T.N.N. (S) equations to published data

There have not been many available data obtained with various enzymes for finding applicable equations. Therefore the author cannot examine T. N. N. (S) equations for many enzymes by utilizing published data. The applicable T. N. N. (S) I or II for his own data and the results of application of them to previously published data obtained by preceding investigators are given below. In the tables the value of $100 - x$ is given as the experimental value.

Lipase

1) Castor bean lipase

(i) Data obtained by NAKAJIMA in the decomposition of soy bean oil. (S) I is satisfactory.[49]

(ii) Data obtained by JALANDER[38] in the decomposition of olive oil. To the data of one of his results (S) I and II have been applied. In this case the probable errors are so large as to be 2 in both calculated results. The value of the difference for the 2nd term is especially large in both results. (S) I and II have also been applied to the data omitting that term. As seen in TABLE CLI (S) I is certainly better than II. At the same time the result of the second term seems to be not accurate.

2) Papain

Data obtained by NAKAJIMA in the decomposition of soy bean oil. (S) II is satisfactory.[49]

Emulsin

Data obtained by TAMMANN[70] in the decomposition of amygdalin seem to follow (S) I as given in TABLE CLII. But the data are not adequate to examine the applicability of equations, for the range of decomposition is very narrow.

Invertase

(i) Data obtained by BROWN·[12] (S) I is satisfactory for BROWN's data as shown in TABLE CLIII.

(ii) Data obtained by BARTH. As shown in TABLE CLIV, Barth's data seem to follow (S) I, the first term of which is omitted in applying the equation, as the value of this term is larger than that of the second and is plotted certainly out of a smooth curve.

Amylase

For data obtained by amylase taking the quantity of enzyme as a variable the author cannot find an applicable equation, which can be explained theoretically. For data obtained by taking the quantity of substrate as a variable, the same premise and conclusion—that there cannot easily be found any applicable equation—is theoretically suggested, as explained previously for data obtained by taking the quantity of enzyme as a variable.

Maltase

Data obtained by HERZOG, BECKER and KASARNOWSKI[35] seem to follow (S) I as seen in TABLE CLV.

Pepsin

Data obtained by NAKAJIMA in the decomposition of normal and denatured glycinins. (S) II is satisfactory.[49]

Pancreatin

Data obtained by NAKAJIMA in the decomposition of normal and denatured glycinins. (S) II is satisfactory.[49]

Papain

Data obtained by NAKAJIMA in the decomposition of normal and denatured glycinins. (S) I is satisfactory.[49]

Data obtained by NAKAJIMA in the decomposition of normal and denatured glycinins. (S) I is satisfactory.[49]

Protease

Data obtained by WEISS[73] with germinated barley. (S) I is satisfactory as seen in TABLES CLVI and CLVII.

Phosphatase

Data obtained by NEMEC[52] with glycerophosphatase. (S) II is better than I as seen in Table CLVIII.

2. Recapitulation of results of application of T.N.N. (S) equations

From the above examination of equations for each kind of enzyme and substrate, the applicable equations are given in TABLE CLIX.

Proposal of the theory of the constancy of the truly applicable equation to data obtained with a given kind of enzyme and a given kind of substrate

As already described, there has been no equation proposed as generally applicable and several kinds of equations have been usually proposed by diffesent investigators for data obtained with a given kind of enzyme and a given kind of substrate. It has been proved that T. N. N. I is widely applicable to data obtained with various enzymes. But one may consider that because the equation has two constants the probable error for T. N. N. I or II is little. To a certain extent this may be true. Although equations that have two constants each are few in enzyme chemistry, even such equations are also always unsatisfactory. Though T. N. N. I or II is generally satisfactory the author does not consider that it is because of its two constants. For trials, he formulated an equation, $\dfrac{1}{t^{k'}} \log \dfrac{a+x}{a-x} = K$ which was obtained by substituting $t^{k'}$ for t in ABERSON's equation. The result of application of the former to data obtained by ABERSON with zymase was less satisfactory than T. N. N. I, as already shown in TABLE CXXIII. On the contrary, for data obtained with amylase taking the relative quantity of enzyme as a variable T. N. N. I and II are not satisfactory, as already shown in TABLES CXXXVII—CXXXIX. Although the experimental curves are very smooth, probable errors are comparatively large. T. N. N. III

was ascertained to be also not satisfactory. The same facts have also been observed for data obtained by using amylase in decomposition taking the quantity of substrate as a variable. The cause of this has been theoretically explained on page 162. Each T. N. N. equation has two constants, yet only one T. N. N. equation is the best applicable, according to the kind of enzyme or the kind of enzyme and substrate. From these observations it is clear that the fact that each T. N. N. equation has two constants is not the cause of its high applicability. It is necessary to consider the items given under paragraph 3 on page 161 for examining the applicability of equations. In the study of a viscosity test of two miscible chemicals T. N. N. equations were proved to have a close relation to the chemical structure of the component.[49]

For data obtained with a given kind of enzyme and substrate more than two equations have been often maintained to be equally well applicable according to the experimental condition. The author considers that there can be only one definite equation which is fundamentally well applicable for such data notwithstanding the experimental condition. As to data obtained with a given kind of enzyme and substrate one of the T. N. N. equations is always satisfactory, i. e. the best applicable equation is always only one definite kind according to the relative properties of the enzyme and the substrate which satisfies the author's consideration above described. For instance the difference of chemism between pepsin and protein from that between trypsin and protein is yet not quite certain. But for the former enzyme, T. N. N. II is satisfactory, while for the latter T. N. N. I. T. N. N. equations are considered to be the general formulae of the equations that were theoretically deduced, such as the monomolecular and bimolecular equations. Therefore one can infer clearly the difference of the two enzymes in the chemism between the enzyme and the protein. The truly applicable equation is considered to be an important key to clear the chemism between the enzyme and substrate.

From the above considerations the author makes the following proposition :

" *The truly applicable equation to data obtained with a given kind of enzyme and substrate is always constant.*"

Conclusion

The author has studied somewhat in the kinetics of enzymes. Some of the principal points are given below.

1. The principal equations proposed by preceding investigators in the study of decomposition by enzymes taking the length of time as a variable have been introduced. The author has shown that all these equations are usually not satisfactory even for the data of each original paper.

2. In the examination of the applicability of equations it is absolutely necessary to take care of several items, most of which have never been taught in enzyme chemistry. Without taking such care the proof of applicability of equations is incomplete. The items proposed by the present author are as follows :

  a) For the experimental data to which the applicability is to be examined, it is necessary to attend to the following :

    1) The range of decomposition must be wide.

    2) The number of experimental terms must not be few.

    3) If the experimental data of a result obtained in the decomposition by enzymes are plotted, and if they are accurate, they are to be on a smooth curve. In the special case of one or a few points which are certainly known at a glance to be out of a smooth curve, that datum or those data must be omitted from calculation in applying equations.

    4) The nature of the equation to be examined and the nature of the experimental curve must be the same.

  b) In estimating the applicability of equations it is necessary to examine :

    1) Not only the uniformity of the values of the constant of the equation but also the magnitude of the mean value of the differences between experimental and caluculated values.

    2) Whether or not the value of the constant of an equation or the value between experimental and calculated values varies in a certain definite tendency.

3. The equation, $\dfrac{1}{t^{k'}} \log \dfrac{a}{a-x} = K$, which was before formulated by the present author, and NAKAMURA's equation, $\dfrac{1}{t^{k'}} \dfrac{x}{a(a-x)} = K$ were named for the sake of convenience T. N. N. I and II respectively. These have already been stated to be the general formulae of equations of the first and second order respectively. T. N. N. equations for the higher orders are considerd in the present paper.

4. The meaning and importance of the applicability of equations

has been shown, and examples showing the imperfection or mistakes of some theories which were deduced from mistaken recognition of applicability of equations in enzyme chemistry have been given.

5. It has been shown that data obtained in the decomposition by enzymes followed T. N. N. I or II with few exceptions. The applicable equations for various enzymes have been determined.

6. The Schütz law $\dfrac{x}{\sqrt{E}} = K$, which was formerly accepted by the precent author for only dilute pepsin, has been refuted.

7. All the equations that have been proposed to be well applicable to data obtained in decomosition taking the relative quantity of enzyme as a variable have been considered to be not applicable.

8. Let E be the relative quantity of enzyme and x the quantity of substrate decomposed and a the quantity of substrate taken. The modified formulae of T. N. N. equations which were obtained before by substituting $E^{k'}$ for $t^{k'}$ in T. N. N. equations were named T. N. N. (E) equations. Their applicability had already been examined for data obtained in the decomposition of soy bean protein and oil.

9. To the data of the principal published reports, T. N. N. (E) equations have been applied and the applicable equations have been determined for various enzymes with few exceptions. Similarly to the data obtained in the decomposition taking time as a varible, some one of the T. N. N. (E) equations is always applicable, according to the kind of substrate and enzyme.

10. To data obtained in decomposition taking the quantity of substrate as a variable, the modified formulae of T. N. N. I and II, $\dfrac{1}{S^{k'}} . \log \dfrac{a}{x} = K$ and $\dfrac{1}{S^{k'}} \dfrac{a-x}{a \cdot x} = K$, where S was the quantity of substrate taken have been gotten. They were named T. N. N. (S) equations. To the author's data and the principal published data they have been applied and the best applicable equation was determined for each kind of enzyme and substrate.

11. Only for data obtained with amylase the applicable T. N. N. (E) or T. N. N. (S) equation could not be determined. The reason was theoretically discussed.

12. The theory of the constancy of a truly applicable equation has been proposed.

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Bibliography

(1) E. Abderhalden and A. Fodor :—C. Oppenheimer's Ferm. u. ihre Wirk. (1924), II, 319.

(2) H. J. Aberson :—Rec. trav. chim., 22, 78 (1903).

(3) E. F. Armstrong :—Proc. Roy. Soc., 73, 500 (1904).

(4) H. E. Armstrong, M. S. Benjamin and E. Horton :—Proc. Roy. Sec., B 86, 328 (1913).

(5) S. Arrhenius :—C. Oppenheimer's Ferm. u. inre Wirk. (1924), II, 242.

(6) S. J. M. Auld :—Journ. Chem. Soc., 93, 1251 (1908).

(7) A. Bach :—Chem. Ber., 38, 1878 (1905).

(8) H. W. Bansi :—Klin. Wochsch., 3, 927 (1924).

(9) H. P. Barendrecht :—Rec. trav. chim., 39, 1 (1920) : C. Oppenheimer's Ferm. u. ihre Wirk. (1924), III, 350.

(10) W. M. Bayliss :—C. Oppenheimer's Ferm u. ihre Wirk., III, 321.

(11) J. Boselli :—Ann. Inst. Pasteur, 25, 695 (1911) ; Chem. Zbl., II, 1463 (1911).

(12) A. J. Brown :—Journ. Chem. Soc., 81, 373 (1902).

(13) H. T. Brown and T. Glendinning :—Journ. Chem. Soc., 81, 388 (1902).

(14) H. Colin and A. Chaudan :—Chem. Zbl., II, 713 (1921).

(15) K. G. Dernby :—Zeit. physiol. Chem., 89, 425 (1914).

(16) W. Dietz :—Zeit. physiol. Chem., 52, 279 (1907).

(17) K. Djenab and C. Neuberg :—Biochem. Zeit., 82, 391 (1917).

(18) S. Edlbacher and E. Simons :—Zeit. physiol. Chem., 167, 76 (1927).

(19) H. Engel :—Hofm. Beitr., 7,77 (1905).

(20) H. Euler :—Horm. Beitr., 7,1 (1905).

(21) H. Euler :—Zeit. physiol. Chem., 44, 53 (1905).

(22)   ,,   :—Zeit. physiol. Chem., 51, 213 (1907); Arkiv. r. Kemi, II, 31, 1 (1907).

(23) H. Euler and E. Brunius :—Zeit. physiol Cem., 175, 52 (1928).

(24) H. Euler and S. Kullberg :—Zeit. phisiol. Chem., 74, 15 (1911).

(25)   ,,   ,,   71, 14 (1911).

(26) A. Faitelowitz :—C. Oppenheimer's Ferm. u. ihre Wirk. (1924), III, 357.

(27) K. Freudenberg and E. Vollbrecht :—Zeit. physiol. Chem., 116, 277 (1921).

(28) F. Geddes and A. Hunter :—Journ. Biol. Chem., 177, 197 (1928).

(29) R. E. Gross :—Zeit. physiol. Chem., 112, 236 (1921).

(30) W. Grossmann and H. Dyckerhoff :—Zeit. physiol. Chem., 177. 41 (1928).

(31) V. Henri :—C. Oppenheimer's Ferm. u. ihre Wirk. (1924) I, 114.

(32) R. O. Herzog :—Zeit. physiol. Chem., 37, 149 (1903).

(33)   ,,   —C. Oppenheimer's Ferm. u. ihre Wirk. (1924), II, 232.

(34)   ,,   —Koninkl. Akad., van Wetensch., Amsterdam, 322 (1903); C. Oppenheimer's Ferm. u. ihre Wirk. II, 286.

(35) R. O. Herzog, C. T. Becker and H. Kasarnowski :—C. Oppenheimer's Ferm. u. ihre Wirk., II, 278.

(36) O. Holmbergh :—Zeit. physiol. Chem , 134, 68 (1924).

(37) W. Issajew :—Zeit. physiol., Chem. 42, 102 (1904); 44. 546 (1905).

(38) Y. W. Jalander :—Biochem. Zeit., 36, 435 (1911).

(39) P. Karrer, B. Joos and M. Staub :—Helv. Chim. atc., 6, 800 (1923).

(40) J. H. Kastle, M. E. Johnston and E. Elvolve :—Amer. Chem. Journ., 31, 521 (1904).

(41) J. H. Kastle and A. S. Loevenhart ;—Amer. Chem. Journ., 24, 491 (1900).

(42) S. Sövgren :—Biochem. Zeit., 137, 206 (1923).

(43) M. Matsuyama and K. Nakamura :—Journ, Soc. Agr. Chem. (Japan) 5, 186 (1929).

(44) S. M. Maximowitsch and E. S. Awtonomova :—Zeit. physiol. Chem., 174, 233 (1928).

(45) L. Michaelis and M. L. Menten :—Biochem. Zeit., 35, 386 (1911).

(46) S. Miyake :—Journ. Fac. Agr., Hokkaido Imp. Univ., XVII, 228 (1927).

(47) S. Morgulis :—Journ. Biol. Chem., 47, 341 (1921).

(48) K. Nakajima :—Journ. Fac. Agr., Hokkaido Imp. Univ., XXVIII, Pt. 2 (1930).

(49)   ,,   :—   ,,   XXXI, Pt. 3 (1932).

(50) Y. Nakamura :—   ,,   XXIII, Pt. 2 (1928).

(51) J. M. Nelson and D. J. Hitchcock :—Journ. Amer. Chem, Soc., 43, 2632. (1921).

(52) A. Nemec :—Biochem. Zeit., 137, 570 (1923).

(53) M. Nicloux :—Soc. Biol., 56, 1, 701 (1904).

(54) C. Oppenheimer :—Ferm. u. ihre Wirk., II, 126.

(55) K. Oshima :—Journ. Fac. Agr., Hokkaido Imp. Univ., XIX, 203 (1928).

(56) C. Philoche :—H. Euler's Chemie d. Enzyme (1922), 129.

(57) G. Pighini :—Biochem. Zeit., 33, 190 (1911).

(58) H. Pringsheim and K. Baur :—Zeit. physiol. Chem., 173, 188 (1928).

(59) H. Pringsheim and J. Leibowitz :—Zeit. physiol. Chem., 131 ,262 (1923).

(60) H. Pringsheim and R. Perewosky :—Zeit. physiol. Chem., 153, 138 (1926).

(61) H. Pringsheim and K. Seifert :—Zeit. physiol, Chem., 128, 284 (1923).

(62) P. Rona and A. Damboviceanu :—Biochem. Zeit., 134, 20 (1922).

(63) P. Rona and J. Ebsen :—Biochem. Zeit., 39, 21 (1912).

(64) P. Rona and H. Kleinmann :—Biochem. Zeit., 159, 146 (1925); 169, 320 (1926).

(65) M. Sandberg and E. Brand :—Journ. Biol. Chem., 64, 59 (1925).

(66) G. Senter :—Zeit., physiol. Chem., 44, 257 (1903); 51, 673 (1905).

(67) A. Schmidt :—C. Oppenheimer's Ferm. u. ihre Wirk. II, 235.

(68) H. C. Sherman and J. A. Walker :—Journ. Amer. Chem. Soc., 39, 1476 (1917).

(69) W. STADE :—Hofm. Beitr., 3, 291 (1902).

(70) G. TAMMANN :—Zeit. physiol. Chem., 16, 271 (1892).

(71) A. E. TAYLOR :—Journ. Biol. Chem., 2, 87 (1906).

(72) D. D. VAN SLYKE and G. E. CULLEN :—Journ, Biol. Chem., 19, 141 (1914).

(73) F. WEISS :—Zeit. ges. Brauw., 26, 301 (1903); C. OPPENHEIMER's Ferm. u. ihre Wirk., III, 333.

(74) D. H. WESTER :—Ber. d. Deutschen pharm. Ges., 30, 163 (1920); Pharm. Zbl., 57, 423 (1916), 61, 293, 377 (1920).

(75) R. WILLSTÄTTER and W. CSÁNYI :—Zeit. physiol. Chem., 117, 172 (1921).

(76) R. WILLSTÄTTER and R. KUHN :—Zeit. physiol. Chem., 115, 180 (1921).

(77) R. WILLSTÄTTER and F. MEMMEN :—Zeit. physiol. Chem., 129, 1 (1922); 133, 229 (1924).

(78) R. WILLSTÄTTER and G. OPPENHEIMER :—Zeit. physiol. Chem., 118, 168 (1922).

(79)   ,,   ,,   121, 183 (1922).

(80) R. WILLSTÄTTER, T. OPPENHEIMER and W. STEIBELT :—Zeit. physiol. Chem., 110, 232 (1920).

(81) R. WILLSTÄTTER and W. STEIBELT :—Zeit. physiol. Chem., 115, 199 (1921).

(82) R. WILLSTÄTTER and A. STOLL :—Ann. d. Chem., 380, 148 (1911); 387, 318 (1911).

(83) R. WILLSTÄTTER and E. WALDSCHMIDT-LEITZ :—Zeit. physiol. Chem., 134, 161 (1924).

(84) R. WILLSTÄTTER, E. WALDSCHMIDT-LEITZ and F. MEMMEN :—Zeit. physiol. Chem., 125, 93 (1923).

(85) E. YAMAZAKI :—Sci. Reports, Tohoku Imp. Univ., IX (1921).

(86) J. ZELLNER :—Monatsh. Chem., 26, 727 (1905); 27, 295 (1906); C. OPPENHEIMER's Ferm. u. ihre Wirk., II, 247.

TABLE I

Data obtained by GROSS with arginase

t (hrs.)	x	$K = \dfrac{1}{t} \ln \dfrac{a}{a-x}$
0	0.0	——
0.25	5.6	0.239
0.75	13.8	0.189
1.5	18.0	0.132
3	30 4	0.127
6	45.6	0.101
9	52.8	0.083
24	72.0	0.053

TABLE II

Result of the application of T.N.N. II to GROSS's
data given in TABLE I

t (hrs.)	x	$\mathrm{II} \begin{cases} K = 0.0018225 \\ k\prime = 0.82575 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2
0.25	5.6	5.5	+0.1	0.01
0.75	13.8	12.8	+1.0	1.00
1.5	18.0	20.3	−2.3	5.29
3	30.4	31.1	−0.7	0.49
6	45.6	44.5	+1.1	1.21
9	52.8	52.8	0.0	0.00
24	72.0	71.5	+0.5	0.25
			+2.7−3.0=−0.3	8.25
			P.E.=±0.9	

TABLE III

Data obtained by MICHAELIS and MENTEN with sucrose (a=0.333 N
sucrose) and result of application of their equation

t (mins.)	$\dfrac{x}{a}$	K	mean
7	0.0164	0.0496	
14	0.0316	0.0479	
26	0.0528	0.0432	
49	0.0923	0.0472	
75	0.1404	0.0408	
117	0.2137	0.0407	
1052	0.9834	[0.0498]	0.0439

TABLE IV

Data obtained by MICHAELIS and MENTEN with sucrose ($a=0.0416$ N sucrose) and result of application of their equation

t (mins.)	x (%)	K (equation 8)
10.25	11.47	0.0406
30.75	37.22	0.0489
61.75	61.5	0.0469
90.75	74.7	0.0438
112.70	85.0	0.0465
132.70	92.5	0.0443
154.70	94.0	0.0405
149.70	97.2	[0.0514]
		mean 0.0445

TABLE V

Result of the application of T.N.N. I to the data obtained by MICHAELIS and MENTEN given in previous table

t (mins.)	x (%)	I $\begin{cases} K=0.02169 \\ k'=0.69538 \end{cases}$	
		Calc. value	Diff.
10.25	11.47	22.26	−10.79
30.75	37.22	41.78	− 4.56
61.75	61.5	58.45	+ 3.05
90.75	74.7	67.69	+ 7.01
112.70	85.0	73.62	+11.38
132.70	92.5	77.58	+14.92
154.70	94.0	81.05	+12.95
149.70	97.2	99.97	− 2.77
			$+49.31-18.12=+31.19$

TABLE VI

Result of the application of T.N.N. I to the data given in TABLE IV omitting the last datum

t (mins.)	x	I $\begin{cases} K=0.0036817 \\ k'=1.150901 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2
10.25	11.47	11.61	−0.14	0.0196
30.75	37.22	36.38	+0.34	0.1156
61.75	61.5	62.28	−0.78	0.6084
90.75	74.7	74.97	−0.27	0.0729
112.70	85.0	85.76	−0.76	0.5776
132.70	92.5	91.31	+1.19	1 3961
154.70	94.0	94.30	−0.30	0.0900
			$+1.53-2.25=-0.72$	2.8802
			P.E.$=\pm 0.5$	

TABLE VII

Results of the application of equations to data obtained by
RONA and DAMBOVICEANU with liver catalase

t	x (%)	$K_1 = \dfrac{1}{t} \ln \dfrac{a}{a-x}$	$K_{1.5} = \dfrac{1}{t} \dfrac{\sqrt{a} - \sqrt{a-x}}{\sqrt{a}\,(a-x)}$	$K_2 = \dfrac{1}{t} \dfrac{x}{a(a-x)}$
5	39.5	—	—	
10	59.08	0.08925	0.00563	0.00144
15	70.41	—	0.00558	
25	82.78	—	0.00563	—
35	85.18	0.06301	0.00533	0.00172
			mean 0.00554	

TABLE VIII

Data obtained with catalase ($1/90$ m H_2O_2 at $25\,^\circ$C) and the result
of the application of monomolecular equation by ISSAJEW

t	$KMnO_4$ (cc.)	x (%)	$10^4 \cdot K = 10^4 \cdot \dfrac{0.4343}{t} \log \dfrac{a}{a-x}$
0	41.8	—	—
5	31.5	24.6	245.7
10	23.7	43.3	246.4
15	17.9	57.2	245.5
20	13.5	67.7	245.4
25	10.2	75.6	245.0
30	7.6	81.9	246.9

TABLE IX

Results of the application of T.N.N. I and II to the
data given in previous table

t	x	I $\begin{cases} K=0.02454 \\ k'=1.00074 \end{cases}$			II $\begin{cases} K=0.2898 \cdot 10^{-3} \\ k'=1.44909 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
5	24.6	24.6	0.0	0.00	23.0	+1.6	2.56
10	43.3	43.2	+0.1	0.01	44.9	−1.6	2.56
15	57.2	57.2	0.0	0.00	59.5	−2.3	5.29
20	67.7	67.8	−0.1	0.01	67.4	+0.3	0.09
25	75.6	75.7	−0.1	0.01	75.5	+0.1	0.01
30	81.9	81.7	+0.2	0.04	80.0	+1.9	3.61
		+0.3−0.2=+0.1 P.E.=±0.1		0.07		+3.9−3.9=0 P.E.=±1.3	14.12

TABLE X

Data obtained with catalase (1/33 m H_2O_2 at $0°C$) and results
of the application of monomolecular equation by ISSAJEW
and of T.N.N. I and II

ISSAJEW's result				I $\begin{cases} K=0.020758 \\ k'=0.99897 \end{cases}$			II $\begin{cases} K=0.16300 \times 10^{-3} \\ k'=1.60621 \end{cases}$		
t (mins.)	$KMnO_4$ (cc.)	x (%)	$K_1 \cdot 10$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
0	48.4	—	——	21.2	+0.1	0.01	17.8	+3.5	12.25
5	38.1	21.3	207.8	37.9	—0.1	0.01	39.7	—1.9	3.61
10	30.1	37.8	206.2	61.4	0.0	0.00	66.8	+5.4	29.16
20	18.7	61.4	206.5	76.0	0.0	0.00	79.4	—3.4	11.56
30	11.6	76.0	206.7	85.1	0.0	0.00	85.9	—0.8	0.64
40	7.2	85.1	206.8	94.2	+0.1	0.01	92.1	+2.2	4.84
60	2.8	94.3	206.2						
					+0.2—0.1=+0.1 P.E.=±0.1	0.03		+11.1—6.1=+5.0 P.E.=±2.3	62.06

$$K_1 = \frac{1}{t} \log \frac{a}{a-x}$$

TABLE XI

Data obtained with catalase by EULER ·

t (mins.)	$KMnO_4$ (cc.)	x (%)	$K. 10^4$
0	8.0	——	——
6	6.9	13.8	107
12	5.8	27.5	116
19	5.0	37.5	107
55	2.5	68.8	100

TABLE XII

Results of the application of T.N.N. I and II to the
data given in previous table

t	x	I $\begin{cases} K=0.013274 \\ k'=0.91799 \end{cases}$			II $\begin{cases} K=0.19598 \times 10^{-3} \\ k'=1.17629 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
6	13.8	14.6	—0.8	0.64	0.64	—0.1	0.01
12	27.5	25.9	+1.6	2.56	2.56	+0.8	0.64
19	37.5	36.6	+0.9	0.81	0.81	—1.0	1.00
55	68.8	70.2	—1.4	1.96	1.96	+0.2	0.04
			+2.5—2.2=+0.3 P.E.=±1.2	5.97		+1.0—1.1=—0.1 P.E=±0.60	1.69

TABLE XIII

SENTER's result obtained with blood catalase

t	$KMnO_4$	x (%)	$0.4343 \cdot K$
0	46.1	——	——
5	37.1	9.0	0.0190
10	29.8	16.3	0.0192
20	19.6	26.5	0.0190
30	12.3	33.8	0.0193
50	5.0	41.1	0.0194

TABLE XIV

Results of the application of T.N.N. I and II to SENTER's data

t	x (%)	I $\begin{cases} K=0.018525 \\ k'=1.00815 \end{cases}$			II $\begin{cases} K=0.66513 \times 10^{-3} \\ k'=1.27501 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
5	9.0	9.0	0.0	0.00	8.9	+0.1	0.01
10	16.3	16.3	0.0	0.00	16.9	−0.6	0.36
20	26.5	26.8	−0.3	0.09	26.9	−0.4	0.16
30	33.8	33.7	+0.1	0.01	32.3	−0.5	0.25
50	41.1	41.0	+0.1	0.01	37.7	+3.4	11.56
			+0.2−0.3=−0.1 P.E.=±0.1	0.11		+4.0−1.0=+3.0 P.E.=±1.4	12.34

TABLE XV

Results of the application of T.N.N. I and II to YAMAZAKI's
data ($C_0=0.02108$, $E_0=4$ cc., $0°C$.)

t	x	I $\begin{cases} K=0.0883 \\ k'=0.92991 \end{cases}$			II $\begin{cases} K=0.60629 \\ k'=2.029319 \end{cases}$		
		Calc. value	Diff. Δ	$\Delta^2 \times 10^{10}$	Calc. value	Diff. Δ	$\Delta^2 \times 10^{10}$
3.4	0.01143	0.01143	0	0	0.01065	+0.00078	6084
6.5	0.01608	0.01603	+0.00005	25	0.01669	−0.00061	3721
11.0	0.01906	0.01903	+0.00003	9	0.01933	−0.00027	729
17.4	0.02074	0.02049	−0.00002	4	0.02035	+0.00012	144
			+0.0008−0.0002 =+0.00006 P.E.=±0.00003	38		+0.00090−0.00088 =+0.00002 P.E.=±0.00049	10678

TABLE XVI

Result of the application of T.N.N. I to YAMAZAKI's
data ($C_0=0.02318$, $E_0=8$ cc., $25°C$)

YAMAZAKI's result			$I\begin{cases}K=0.14985\\k\prime=0.82907\end{cases}$		
t (mins.)	x	$k\prime$	Calc. value	Diff. Δ	$\Delta^2 \times 10^{10}$
2.4	0.01183	6.03	0.01182	+0.00001	1
6.3	0.01840	5.56	0.01844	--0.00004	16
10.6	0.02119	5.66	0.02117	+0.00002	4
15.7	0.02239	5.54	0.02239	0	0
		5.70		+0.00003—0.00004 $=-0.00001$ P.E.$=\pm0.00002$ $(\pm0.09\%)$	21

TABLE XVII

Result of the application of T.N.N. I to YAMAZAKI's data
($C_0=0.02318$, $E_0=4$ cc., $25°C$.)

YAMAZAKI's result			$I\begin{cases}K=0.097008\\k\prime=0.67874\end{cases}$		
t (mins.)	x	$k\prime$	Calc. value	Diff. Δ	$\Delta^2 \times 10^{10}$
4.1	0.01014	5.96	0.01023	—0.00009	81
8.7	0.01434	5.78	0.01439	—0.00005	25
16.5	0.01830	5.66	0.01799	+0.00031	961
25.8	0.02015	5.44	0.02013	+0.00002	4
39.0	0.02149	1.28	0.02160	—0.00011	121
		5.82		+0.00033—0.00025 $=0.00008$ P.E.$=\pm0.00010$ $(\pm0.43\%)$	1192

TABLE XVIII

Result of the application of T.N.N. I to YAMAZAKI's data
($C_0=0.02318$, $E_0=2$ cc., $25°C$)

YAMAZAKI's result			$I\begin{cases}K=0.078468\\K\prime=0.43145\end{cases}$			$I(t: 3.9-33.4)\begin{cases}K=0.065867\\k\prime=0.51065\end{cases}$		
t (mins.)	x	$k\prime$	Calc. value	Diff. Δ	$\Delta^2 \times 10^{10}$	Diff.	Diff. Δ	$\Delta^2 \times 10^{10}$
3.9	0.00583	6.49	0.00655	—0.00072	5184	0.00607	—0.00014	196
8.7	0.00877	5.88	0.00854	+0.00023	529	0.00851	+0.00026	676
14.6	0.01081	5.68	0.01013	+0.00068	4624	0.01041	+0.00040	1600
21.6	0.01216	5.55	0.01147	+0.00069	4761	0.01199	+0.00007	49
33.4	0.01332	5.38	0.01298	+0.00034	1156	0.01385	—0.00053	2809
63.8	0.01418	—	0.01535	—0.00117	13689	—	—	
		5.66		+0.00194—0.00189 $=+0.00005$ P.E.$=\pm0.00052$ (2.2%)	29943		+0.00073—0.00067 $=+0.00007$ P.E.$=\pm0.00025$ (1.1%)	5330

Table XIX

Result of the application of T.N.N. I to Yamazaki's data
$(C_0=0.01159, E_0=2$ cc., $25°C)$

Yamazaki's result			$I\begin{cases} K=0.086284 \\ k'=0.81227 \end{cases}$		
t (mins.)	x	k'	Calc. value	Diff. Δ	$\Delta^2 \times 10^{10}$
3.5	0.00485	5.99	0.00486	—0.00001	1
7.3	0.00740	5.79	0.00732	+0.00008	64
13.5	0.00939	5.51	0.00935	+0.00004	16
22.0	0.01055	5.22	0.01055	—0.00004	16
		5.63		+0.00012—0.00005 $=+0.00007$ P.E.$=\pm0.00004$ $(\pm0.35\%)$	97

Table XX

Maximowitsch's result obtained with blood catalase and results
of the application of his equation and T.N.N. I

0.0075 cc. of blood ; $A=7.3$

Maximowitsch's result						$I\begin{cases} K=0.036144 \\ k'=0.61634 \end{cases}$		
t	$A-x$	x	C_1	C_M	D	Calc. value	Diff. Δ	$\Delta^2 \times 10^4$
10	5.3	2.00	0.0139	0.0031	$D_{t_{10}}-t_{15}=5.7$	2.06	—0.06	36
15	4.65	2.65	0.0131	0.0032	$D_{t_{10}}-t_{30}=5.54$	2.60	+0.05	25
20	4.15	3.15	0.0123	0.0034	$D_{t_{10}}-t_{40}=5.67$	2.99	+0.16	256
30	3.65	3.65	0.0100	0.0031	$D_{t_{10}}-t_{60}=5.6$	3.59	+0.06	36
40	3.2	4.1	0.00897	0.0032	$D_{t_{10}}-t_{20}=6.776$	4.01	+0.09	81
60	2.75	4.55	0.0054	0.0029	$D_{t_{15}}-t_{30}=5.1$	4.71	—0.16	256
					$D_{t_{15}}-t_{60}=5.2$			
					$D_{t_{15}}-t_{40}=5.15$			
					$D_{t_{20}}-t_{60}=5.15$		+0.36—0.22$=+0.14$ P.E.$=\pm0.09$	690
					$D_{t_{30}}-t_{40}=5.57$			
					mean 5.57			

Range of decomposition : 30.83% ; $C_1=\dfrac{1}{t}\log\dfrac{A}{A-x}$, $C_M=\dfrac{1}{t(A-D)}\log\dfrac{D(A-x)}{A(D-x)}$

TABLE XXI

MAXIMOWITSCH's result obtained with blood catalase and results of the application of his equation and T.N.N. I

0.0075 cc. of blood; $A=14.6$

MAXIMOWITSCH's result					$1\begin{cases}K=0.042368\\k'=0.41416\end{cases}$		
t (mins.)	x	C_1	C_M	D	Calc. value	Diff. Δ	Δ^2
10	3.05	0.0600	0.0025	$D_{t_{10}}-t_{20}=5.865$	3.23	-0.18	0.0324
15	3.9	0.0422	0.0025	$D_{t_{10}}-t_{30}=5.875$	3.78	$+0.12$	0.0144
20	4.35	0.0326	0.0026	$D_{t_{10}}-t_{40}=5.865$	4.18	$+0.17$	0.0289
30	5.0	0.0227	0.0025	$D_{t_{10}}-t_{60}=5.855$	4.80	$+0.20$	0.0400
40	5.35	0.0178	0.0025	$D_{t_{15}}-t_{30}=5.825$	5.29	$+0.06$	0.0036
60	5.70	0.0102	0.0035	$D_{t_{20}}-t_{40}=5.775$	6.02	-0.32	0.1024
				$D_{t_{20}}-t_{40}=5.825$			
				$D_{t_{20}}-t_{6)}=5.975$			
				mean 5.875		$+5.5-0.50=-0.5$ P.E.$=\pm0.14$	0.2217

Range of decomposition: 18.15%; $C_1=\dfrac{1}{t}\log\dfrac{A}{A-x}$, $C_M=\dfrac{1}{t(A-D)}\log\dfrac{D(A-x)}{A(D-x)}$

TABLE XXII

MAXIMOWITSCH's result obtained with blood catalase and results of the application of his equation and T.N.N. I

0.0075 cc. of blood, $A=58.4$

MAXIMOWITSCH's result					$1\begin{cases}K=0.016329\\k'=0.25045\end{cases}$		
t (mins.)	x	C_1	C_M	D	Calc. value	Diff. Δ	Δ^2
10	3.6	0.00276	0.00095	$D_{t_{10}}-t_{20}=5.125$	3.76	-0.16	0.0256
15	4.25	0.00219	0.00093	$D_{t_{10}}-t_{30}=5.075$	4.15	$+0.10$	0.0100
20	4.65	0.00180	0.00096	$D_{t_{15}}-t_{30}=5.125$	4.44	$+0.21$	0.0441
30	4.95	0.00128	0.00093	$D_{t_{15}}-t_{40}=5.08$	4.90	$+0.05$	0.0025
40	5.05	0.00098	0.00092	$D_{t_{20}}-t_{30}=5.075$	5.26	-0.21	0.0441
				mean 5.1		$+0.36-0.37=-0.01$ P.E.$=\pm0.12$	0.1263

Range of decomposition: 2.22%; $C_1=\dfrac{1}{t}\log\dfrac{A}{A-x}$, $C_M=\dfrac{1}{t(A-D)}\log\dfrac{D(A-x)}{A(D-x)}$

Table XXIII

Maximowitsch's result obtained with blood catalase and results
of the application of his equation and T.N.N. I

0.015 cc. of blood, $A = 7.4$

	Maximowitsch's result				$\begin{cases} K = 0.042391 \\ k' = 0.81664 \end{cases}$		
t (mins.)	x	C_1	C_M	D	Calc. value	Diff. Δ	Δ^2
10	3.4	0.027	0.0023	$D_{t_{10}} - t_{40} = 15.1$	3.5	−0.1	0.01
15	4.4	0.026	0.0024	$D_{t_{10}} - t_{60} = 13.75$	4.4	0.0	0.00
20	5.075	0.026	,,	$D_{t_{15}} - t_{30} = 14.785$	5.0	+0.075	0.005625
30	5.9	0.023	,,	$D_{t_{15}} - t_{40} = 13.6$	5.9	0.0	0.00
40	6.4	0.022	,,	$D_{t_{20}} - t_{80} = 13.0$	6.4	0.0	0.00
60	6.9	0.022	0.0023	$D_{t_{20}} - t_{60} = 12.25$	6.9	0.0	0.00
				mean 13.7		+0.075−0.1 = −0.025	0.15625
						P.E. = ±0.0	

Range of decomposition : 33.78% ; $C_1 = \frac{1}{t} \log \frac{A}{A-x}$, $C_M = \frac{1}{t(A-D)} \log \frac{D(A-x)}{A(D-x)}$

Table XXIV

Maximowitsch's result obtained with blood catalase and results
of the application of his equation and T.N.N. I

0.015 cc. of blood, $A = 14.8$

	Maximowitsch's result				$\begin{cases} K = 0.055949 \\ k' = 0.58544 \end{cases}$		
t (mins.)	x	C_1	C_M	D	Calc. resltu	Diff. Δ	Δ^2
10	5.45	0.0199	0.0018	$D_{t_{10}} - t_{20} = 14.5$	5.79	−0.34	0.1156
15	6.9	0.0182	,,	$D_{t_{10}} - t_{40} = 13.8$	6.91	−0.01	0.0001
20	7.95	0.0167	,,	$D_{t_{10}} - t_{60} = 14.3$	7.77	+0.18	0.0324
30	9.3	0.0163	,,	$D_{t_{15}} - t_{30} = 13.85$	9.04	+0.26	0.0676
40	10.15	0.0126	,,	$D_{t_{15}} - t_{60} = 14.4$	9.95	+0.20	0.0400
60	11.4	0.0107	0.0019		11.21	+0.19	0.0361
120	12.725	0.00071	,,		13.03	−0.305	0.093025
				mean 14.17			0.384825
						+0.83−0.655 = +0.175	
						P.E = ±0.19	

Range of decomposition : 26.01% ; $C_1 = \frac{1}{t} \log \frac{A}{A-x}$, $C_M = \frac{1}{t(A-D)} \log \frac{D(A-x)}{A(D-x)}$

TABLE XXV

MAXIMOWITSCH's result obtained with blood catalase and results
of the applications of his equation and T.N.N. I

0.0015 cc. of blood, $A=19.5$

MAXIMOWITSCH's result					$I\begin{cases}K=0.046898\\k'=0.35254\end{cases}$		
t (mins.)	x	C_1	C_M	D	Calc. value	Diff. Δ	Δ^2
10	4	0.0099	0.0023	$D_{t_{10}}-t_{20}=6.5$	4.2	-0.2	0.04
15	4.95	0.0085	0.0025	$D_{t_{10}}-t_{30}=6.7$	4.77	$+0.18$	0.0324
20	5.4	0.0070	0.0024	$D_{t_{10}}-t_{20}=6.45$	5.2	$+0.2$	0.04
30	6.0	0.0053	0.0024		5.9	$+0.1$	0.01
40	6.1	0.0041			6.4	-0.3	0.09
60	6.1	—		mean 6.55			
						$+0.48-0.5=-0.02$ P.E.$=\pm0.16$	0.2124

Range of decomposition : 19.5% ; $C_1=\dfrac{1}{t}\log\dfrac{A}{A-x}$, $C_M=\dfrac{1}{t\,(A-D)}\log\dfrac{D(A-x)}{A(D-x)}$

TABLE XXVI

MAXIMOWITSCH's result obtained with blood catalase and results
of the application of his equation and T.N.N. I

0.003 cc. of blood, $A=19.5$

MAXIMOWITSCH's result					$II\begin{cases}K=0.111126\\k'=0.35639\end{cases}$		
t (mins.)	x	C_1	C_M	D	Calc. value	Diff. Δ	Δ^2
10	8.05	0.0231	0.0030	$D_{t_{10}}-t_{40}=13.1$	8.60	-0.55	0.3025
15	9.7	0.0199	0 0032	$D_{t_{10}}-t_{60}=12.4$	9.54	$+0.16$	0.0256
20	10.7	0.0173	0.0033	$D_{t_{10}}-t_{40}=12.75$	10.02	$+0.68$	0.4624
30	11.6	0.0131	0.0032	$D_{t_{15}}-t_{40}=12.85$	11.25	$+0.35$	0.1225
40	12.16	0.0106	0.0034	$D_{t_{15}}-t_{40}=12.85$	11.98	$+0.18$	0.0324
60	12.45	0.0074	0.0030		13.01	-0.56	0.3136
				mean 12.79			
						$+1.37-1.11=-0.26$ P.E.$=\pm0.34$	1.2590

Range of decomposition : 22.31% ; $C_1=\dfrac{1}{t}\log\dfrac{A}{A-x}$, $C_M=\dfrac{1}{t\,(D-x)}\log\dfrac{D(A-x)}{A(D-x)}$

Table XXVII

Maximowitsch's result obtained with blood catalase and results
of the application of his equation and T.N.N. I

0.0045 cc. of blood, $A = 19.5$

MAXIMOWITSCH's result					$I\begin{cases}K=0.11330\\k\prime=0.55465\end{cases}$		
t (mins.)	x	C_1	C_M	D	Calc. value	Diff. Δ	Δ^2
10	11.5	0.0387	0.0030	$D_{t_{10}} - t_{40} = 21.$	11.85	−0.35	0.1225
15	13.55	0.0344	0.0031	$D_{t_{10}} - t_{10} = 20.5$	13.46	+0.09	0.0081
20	14.8	0.0309	0.0032	$D_{t_{15}} - t_{40} = 20.25$	14.57	+0.23	0.0529
30	16.25	0.0259	0.0032	$D_{t_{20}} - t_{40} = 20.25$	16.01	+0.24	0.0576
40	16.95	0.0221	0.0031	$D_{t_{30}} - t_{60} = 19.65$	16.91	+0.04	0.0016
60	17.75	0.0078	0.0030		17.94	−0.19	0.0361
				mean 20.33		+0.60−0.54=+0.06 P.E.=±0.16	0.2788

Range of decomposition : 33.85% ; $C_1 = \dfrac{1}{t} \log \dfrac{A}{A-x}$, $C_M = \dfrac{1}{t\,(D-x)} \log \dfrac{D\,(A-x)}{A\,(D-x)}$

Table XXVIII

Results of the application of T.N.N. I and II to data obtained
with liver catalase by Rona and Damboviceanu
given in Table VII

t (mins.)	x (%)	$I\begin{cases}K=0.066985\\k\prime=0.75181\end{cases}$			$II\begin{cases}K=0.8734\times 10^{-3}\\k\prime=1.23235\end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
5	39.50	40.38	−0.88	0.7744	38.83	+0.67	0.4489
10	59.08	58.14	+0.94	0.8836	59.82	−0.74	0.5476
15	70.41	69.32	+1.09	1.1881	71.08	−0.67	0.4489
25	82.78	82.35	+0.43	0.1849	82.19	+0.59	0.3481
30	85.18	86.32	−1.14	1.2996	85.24	−0.06	0.0036
			+2.46−2.02=+0.44 P.E=±0.81	4.3306		+1.26−1.47=+0.21 P.E.=±0.52	1.7971

TABLE XXIX

Results of the application of T.N.N. I and II to data obtained
with liver catalase by RONA and DAMBOVICEANU

Rona's result						II $\begin{cases} K=0.79028 \times 10^{-3} \\ k'=1.05471 \end{cases}$		
t (mins.)	O_2 (%)	K_1	$K_{1\cdot5}$	K_2	Calc. value	Diff. Δ	Δ^2
5	30.23	0.06287	0.00395	0.00086	30.14	+0.09	0.0081
10	46.71	—	0.00365	0.00087	47.27	—0.56	0.3136
15	58.39	—	0.00369	0.00093	57.89	+0.50	0.2500
25	40.41	—	0.00366	0.00093	40.19	+0.22	0.0484
30	73.80	0.04459	0.00315	0.00094	74.06	—0.26	0.0676
			10.00362			+0.81—0.82=—0.01 P.E.=±0.25	0.6877

$$K_1 = \frac{1}{t} \ln \frac{a}{a-x}, \quad K_{1\cdot5} = \frac{1}{t} \frac{\sqrt{a}-\sqrt{a-x}}{\sqrt{a}-(a-x)}, \quad K_2 = \frac{1}{t} \frac{x}{a(a-x)}$$

TABLE XXX

Result of the application of T.N.N. I to data obtained by
NICLOUX with cotton seed oil and castor bean lipase

NICLOUX's result			I $\begin{cases} K=0.0055146 \\ k'=0.91376 \end{cases}$		
(t mins.)	x (%)	$10^2 \cdot K = \frac{10^2}{t} \log \frac{100}{100-x}$	Calc. value	Diff. Δ	Δ^2
30	23.6	0.388	24.7	+1.1	1.21
40	33.1	0.387	33.7	+0.6	0.36
60	40.4	0.375	41.4	+1.0	1.00
90	54.8	0.382	53.9	—0.9	0.81
127	67.0	0.392	65.4	—1.6	2.56
150	73.2	0.381	71.0	—2.2	4.84
210	85.5	0.399	81.4	—4.1	16.81
450	94.4	0.278	96.6	+2.2	4.84
				+4.9—8.8=—3.9 P.E.=±1.6	32.43

TABLE XXXI

Result of the application of T.N.N. I to data obtained by
WILLSTÄTTER and WALDSCHMIDT-LEITZ with
olive oil and castor bean lipase

					$(t : 25 \sim 160)$ $I \begin{cases} K = 0.0071164 \\ k' = 0.78582 \end{cases}$		
t (mins.)	x	$K = \dfrac{1}{t} \log \dfrac{a}{a-x}$	$K_1 = \dfrac{x}{t}$	$K_2 = \dfrac{x}{\sqrt{t}}$	Calc. value	Diff. Δ	Δ^2
2.5	3.1	0.0055	1.2	2.1	3.3	−0.2	0.04
5	6.0	0.0054	1.2	2.7	5.6	+0.4	0.16
10	9.6	0.0044	1.0	3.0	9.5	+0.1	0.01
20	15.7	0.0037	0.8	3.5	15.8	−0.1	0.01
40	26.3	0.0033	0.7	4.2	25.7	+0.6	0.36
80	40.9	0.0029	0.5	4.6	40.1	+0.8	0.64
160	57.0	0.0023	0.4	4.5	58.7	−1.7	2.89
320	66.6	0.0015	0.2	3.7	——	——	
						+1.9−2.0=−0.1 P.E. = ±0.6	4.11

TABLE XXXII

Result of the application of T.N.N. I to data obtained by
WILLSTÄTTER and WALDSCHMIDT-LEITZ with
castor bean oil and lipase

		WILLSTÄTTER's result			$(t : 5 \sim 240)$ $I \begin{cases} K = 0.006119 \\ k' = 0.73340 \end{cases}$		
t (mins.)	x	$K = \dfrac{1}{t} \log \dfrac{a}{a-x}$	$K_1 = \dfrac{x}{t}$	$K_2 = \dfrac{x}{\sqrt{t}}$	Calc. value	Diff. Δ	Δ^2
5	4.3	0.0038	0.9	1.9	3.9	+0.4	0.16
10	7.0	0.0032	0.7	2.2	7.3	−0.3	0.09
20	11.6	0.0027	0.6	2.6	11.9	−0.3	0.09
40	21.7	0.0027	0.5	3.4	19.0	+2.7	7.29
80	31.5	0.0021	0.4	3.5	29.5	+2.0	4.00
160	44.6	0.0016	0.3	3.5	44.1	+0.5	0.25
240	49.7	0.0012	0.2	3.2	54.3	−4.7	22.09
320	54.2	0.0011	0.17	3.0	——	——	
400	57.6	0.0009	0.14	2.9	——	——	
						+5.6−5.3=+0.3 P.E. = ±1.6	33.97

TABLE XXXIII

Result of the application of T.N.N. I to data obtained
by TAYLOR in the decomposition of triacetin

TAYLOR's result			$I\begin{cases} K=0.0098375 \\ k'=1.01164 \end{cases}$		
t (hrs.)	x (%)	$K.10^4 = \dfrac{10^4}{t} \log \dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2
4	8.3	94	8.8	-0.5	0.25
8	17.4	104	16.9	$+0.5$	0.25
16	33.8	112	31.2	$+2.6$	6.76
24	41.8	98	43.1	-1.3	1.69
28	48.8	104	48.8	0.0	0.00
32	54.2	106	53.0	$+1.2$	1.44
40	60.9	102	61.2	-0.3	0.09
48	65.5	96	67.9	-2.4	5.76
				$+4.3-4.5=-0.2$ P.E.$=\pm 1.0$	16.24

TABLE XXXIV

Results of the application of T.N.N. I and II to data obtained
by SANDBERG and Brand in the dcomposition of olive oil

SANDBERG's result			$I\begin{cases} K=0.0030368 \\ k'=0.58036 \end{cases}$			$(t:10\sim 160)$ $I\begin{cases} A=0.0027583 \\ k'=0.60872 \end{cases}$		
t (mins.)	x (%)	$\dfrac{x}{\sqrt{t}}=K$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
10	2.3	0.73	2.6	-0.3	0.09	2.5	-0.2	0.04
20	4.2	0.94	3.9	$+0.3$	0.09	3.9	$+0.3$	0.09
40	6.1	0.96	5.7	$+0.4$	0.16	5.8	$+0.3$	0.09
60	7.6	0.98	7.3	$+0.3$	0.09	7.4	$+0.2$	0.04
80	8.8	0.98	8.5	$+0.3$	0.09	8.7	$+0.1$	0.01
120	10.8	0.98	10.7	$+0.1$	0.01	11.0	-0.2	0.04
160	12.3	0.97	12.3	0.0	0.00	13.7	-1.4	1.96
320	16.7	0.93	18.1	-1.4	1.96	——	——	——
				$+1.4-1.7=-0.3$ P.E.$=\pm 0.4$	2.49		$+0.9-1.0=-0.9$ P.E.$=\pm 0.4$	2.27

(*To be continued*)

Table XXXIV (Continued)

Results of the application of T.N.N. I and II to data
obtained by Sandberg and Brand in the
decomposition of olive oil

t (mins.)	x (%)	$\dfrac{x}{\sqrt{t}}=K$	II $\begin{cases} K=0.6667\times10^{-4} \\ k'=0.60297 \end{cases}$			$(t:10\sim160)$ II $\begin{cases} K=0.61407\times10^{-4} \\ k'=0.62678 \end{cases}$		
			Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
10	2.3	0.73	2.6	−0.3	0.09	2.5	−0.2	0.04
20	4.2	0.94	3.9	+0.3	0.09	3.9	+0.3	0.09
40	6.1	0.96	5.8	+0.3	0.09	5.8	+0.3	0.09
60	7.6	0.98	7.3	+0.3	0.09	7.4	+0.2	0.04
8o	8.8	0.98	8.6	+0.2	0.04	8.7	+0.1	0.01
120	10.8	0.98	10.7	+0.1	0.01	11.0	−0.2	0.04
160	12.3	0.97	12.5	−0.2	0.04	12.9	−0.6	0.36
320	16.7	0.93	17.8	−1.1	1.21	——	——	——
				+1.2−1.6=−0.4 P.E.=±0.3	1.66		+0.9−1.0=−0.1 P.E.=±0.2	0.67

Table XXXV

Result of the application of T.N.N. I to data obtained
by Sandberg and Brand in the decomposition
of olive oil in the presence of $CaCl_2$

Sandberg's result			II $\begin{cases} K=0.15122\times10^{-3} \\ k'=0.60391 \end{cases}$		
t (mins.)	x (%)	$\dfrac{x}{\sqrt{t}}=K$	Calc. value	Diff. Δ	Δ²
20	8.3	0.186	8.4	−0.1	0.01
40	12.5	0.198	12.3	+0.2	0.04
60	15.4	0.199	15.2	+0.2	0.04
80	17.6	0.197	17.6	0.0	0.00
160	24.2	0.191	24.5	−0.3	0.09
320	33.0	0.185	33.0	0.0	0.00
				+0.4−0.4=0 P.E.=±0.1	0.18

TABLE XXXVI

Results of the application of T.N.N. I and II to data obtained
by ZELLNER in the decomposition of olive oil with
lipase of fly amanita

ZELLNER's data		I $\begin{cases} K=0.47302 \times 10^{-3} \\ k'=0.98948 \end{cases}$			II $\begin{cases} K=0.67832 \times 10^{-5} \\ k'=1.10701 \end{cases}$		
t (hrs.)	x	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
48	4.8	4.8	0.0	0.0	4.7	+0.1	0.01
111	11.5	10.8	+0.7	0.49	11.8	−0.3	0.09
160	14.2	15.2	−1.0	1.00	15.7	−1.5	2.25
304	28.5	26.8	+1.7	2.89	27.5	+1.0	1.00
485	38.9	39.0	−0.1	0.01	38.9	0.0	0.00
631	46.3	47.4	−1.1	1.21	46.0	+0.3	0.09
			+2.4−2.2=+0.2 P.E.=±0.7	5.60		+1.4−1.8=−0.4 P.E.=±0.6	3.44

TABLE XXXVII

Calculated result obtained in the application of ARRHENIUS's

equation, $K.F = \dfrac{F}{t} \log \dfrac{a}{a-x} - \dfrac{x}{t}$ to the data of STADE

obtained in the decomposition of egg-yolk
with stomach lipase

t (hrs.)	x (%)	Calc. value	Diff.	t (hrs.)	x (%)	Calc. value	Diff.
2	20.4	18.6	+1.8	29	51.5	58.2	−6.7
4	25.6	25.7	−0.1	31	55.4	59.6	−4.2
6	29.8	30.8	−1.0	35	60.9	60.9	−1.1
8	35.3	34.8	+0.5	75	76.5	76.5	−1.9
10	38.3	38.3	−0.7				
25	49.5	55.2	−5.7				
							+2.3−21.4=−19.1 mean 2.4

Table XXXVIII

Results of the application of T.N.N. I to the data obtained by Stade given in previous table

t(hrs.)	x (%)	II $\{K=0.0013651, k'=0.66538\}$			$(t: 2\sim35)$ II $\{K=0.0015538, k'=0.59826\}$		
		Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
2	20.4	17.8	+2.6	6.76	19.0	+1.4	1.96
4	25.6	25.6	0.0	0.00	26.5	−0.9	0.81
6	29.8	31.0	−1.2	1.44	31.2	−1.4	1.96
8	35.3	35.3	0.0	0.00	35.0	+0.3	0.09
10	37.6	38.7	−1.1	1.21	38.1	−0.5	0.25
25	49.5	53.8	−4.3	18.49	51.6	−2.1	4.41
29	51.5	56.2	−4.7	22.09	53.8	−2.3	5.29
31	55.4	57.3	−1.9	3.61	54.8	+0.6	0.36
35	60.9	59.2	+1.7	2.89	56.6	+4.3	18.49
75	76.5	70.7	+5.8	33.64	——	——	——
			+10.1−13.2=−3.1 P.E.=±2.0	90.13		+6.6−7.2=−0.6 P.E.=±1.5	33.62

t(hrs.)	x (%)	$(t: 2\sim29)$ II $\{K=0.00168708, k'=0.54581\}$			$\begin{pmatrix}t: 25, 29, 31 \\ \text{omitted}\end{pmatrix}$ II $\{K=0.0013026, k'=0.71272\}$		
		Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
2	20.4	19.8	+0.6	0.36	17.6	+2.8	7.84
4	25.6	26.4	−0.8	0.64	25.8	−0.3	0.09
6	29.8	31.0	−1.2	1.44	31.8	−2.0	4.00
8	35.3	34.4	+0.9	0.81	36.4	−1.1	1.21
10	37.6	37.2	+0.4	0.16	40.2	−2.6	6.76
25	49.5	49.5	+0.1	0.01	——	——	——
29	51.5	51.5	0.0	0.00	——	——	——
31	55.4	——	——	——	——	——	——
35	60.9	——	——	——	62.2	−1.3	1.69
75	76.5	——	——	——	73.9	+2.6	6.76
			+2.0−2.0=0 P.E.=±0.9	3.42		+5.4−7.3=−1.9 P.E.=±1.5	28.35

Table XXXIX

Data obtained by Engel with pancreas lipase

	(i) 0.04 g.	(ii) 0.09 g.	(iii) 0.16 g.
t (hrs.)	x (%)	x (%)	x (%)
4	17.6	20.9	35.2
9	18.4	36.3	48.4
25	35.0	58.2	72.1

Table XL

Results of the application of T.N.N. I and II to data obtained by Willstätter and Memmen in the decomposition of triacetin with pancreas lipase

t (mins.)	x (%)	I $\begin{cases} K=0.0030603 \\ k'=0.52524 \end{cases}$			II $\begin{cases} K=0.68273 \times 10^{-4} \\ k'=0.59235 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
16	3.2	3.4	—0.2	0.04	3.4	—0.2	0.04
25	4.5	4.4	+0.1	0.01	4.4	+0.1	0.01
36	5.6	5.4	+0.2	0.04	5.4	+0.2	0.04
49	6.7	6.4	+0.3	0.09	6.4	+0.3	0.09
64	7.6	7.4	+0.2	0.02	7.4	+0.2	0.04
81	8.4	8.5	—0.1	0.01	8.4	0.0	0.00
100	8.9	9.5	—0.6	0.36	9.5	—0.6	0.36
		+0.8—0.9=—0.1		0.57	+0.8—0.8=0		0.58
		P.E.=±0.2			P.E.=±0.2		

TABLE XLI

Results of the application of T.N.N. I and II to data
obtained by DIETZ in the synthesis of ester

	DIETZ's result			I $\{K=0.0065154, k'=0.99344\}$			II $\{K=0.112455\times10^{-3}, k'=1.18012\}$		
t (mins.)	Acid*	$K_1\cdot10^4$	x	Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
——	100.00								
2.00	97.06	64	2.94	2.94	0.00	0.0000	2.48	+0.46	0.2116
9.57	87.10	62	12.90	13.19	−0.29	0.0841	13.91	−1.01	1.0201
14.35	80.84	64	19.16	19.05	+0.11	0.0121	20.68	−1.52	2.3104
24.55	69.74	63	30.26	30.18	+0.08	0.0064	32.84	−2.58	6.6564
31.88	62.38	63	37.62	37.34	+0.28	0.0784	40.07	−2.45	6.0025
47.98	48.32	65	51.68	50.43	+1.25	1.5625	52.00	−0.32	0.1024
55.27	43.56	64	56.44	55.41	+1.03	1.0609	56.15	+0.29	0.0841
76.67	33.94	60	66.06	67.31	−1.25	1.5625	65.33	+0.73	0.5329
100.42	23.98	62	76.02	76.81	−0.79	0.6241	72.15	+3.87	14.9769
					+2.75−2.33 =+0.42 P.E.=±0.53	4.9910		+5.35−7.88 =−2.53 P.E.=±1.35	31.8973

* Acid quantity in millimol in 1 L.

TABLE XLII

Results of the application of T.N.N. I and II to data obtained
by DIETZ in the synthesis of ester, taking
83.95 as the value of a

	DIETZ's result			I $\{K=0.0096188, k'=1.00137\}$			II $\{K=0.138025\times10^{-3}, k'=1.34009\}$		
t (hrs.)	Acid*	$K_1\cdot10^4$	x	Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
0.0	100.00	—							
3.9	93.74	72	6.26	7.00	−0.74	0.5476	5.62	+0.64	0.4096
10.52	80.83	90	19.17	17.50	+1.67	2.7889	17.92	+1.25	1.5625
13.75	77.50	89	22.50	22.10	+0.40	0.1600	23.49	−0.99	0.9801
23.32	65.00	84	35.00	33.97	+1.03	1.0609	34.34	+0.66	0.4356
29.25	59.17	83	40.83	40.16	+0.67	0.4489	43.36	−2.53	6.4009
36.20	53.33	82	46.67	46.45	+0.22	0.0484	49.28	−2.61	6.8121
47.97	45.00	81	55.00	55.10	−0.10	0.0100	56.63	−1.63	2.6569
71.68	33.34	81	66.66	69.95	−0.29	0.0841	65.50	+1.16	1.3456
97.57	27.08	76	72.92	74.41	−1.49	2.2201	70.77	+2.15	4.6225
∞	16.05	—	83.95						
					+3.99−2.92 =+1.37 P.E.=±0.65	7.3689		+5.86−7.76 =−1.90 P.E.=±1.20	25.2258

* Acid quantity in millimol in 1 L.

TABLE XLIII

Results of the application of T.N.N I and II to data obtained
by DIETZ in the decomposition of ester taking
16.25 as the value of a

DIETZ's result			I $\begin{cases} K=0.018235 \\ k'=0.79576 \end{cases}$			II $\begin{cases} K=0.0025657 \\ k'=0.98511 \end{cases}$		
t (hrs.)	Acid*	$K_2 \cdot 10^4$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
0	0							
6.67	2.50	18	2.81	−0.31	0.0961	3.46	−0.96	0.9216
19.73	6.50	18	5.89	+0.61	0.3721	7.15	−0.60	0.3600
32.65	8.08	15	8.10	−0.02	0.0004	9.16	−1.08	1.1664
68.10	12.50	15	11.39	+1.11	1.2321	11.82	+0.68	0.4624
94.30	13.08	mean 16	12.85	+0.23	0.0529	12.77	+0.31	0.0961
142.31	14.00		14.40	−0.40	0.1600	13.75	+0.25	0.0625
215.50	15.00		15.45	−0.45	0.2025	14.50	+0.50	0.2500
∞	16.25			+1.95−1.18	2.1161		+1.74−2.64	3.3190
				=−0.77			=−0.90	
				P. E.=±0.45			P. E.=±0.50	

* Acid quantity in millimol in 1 L.

TABLE XLIV

Result of the application of T.N.N. I to the data obtained by
DIETZ given in previous table, omitting the 4th datum

t (hrs.)	x	I $\begin{cases} K=0.018190 \\ k'=0.78804 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2
6.67	2.50	2.77	−0.27	0.0729
19.73	6.50	5.78	+0.72	0.5184
32.65	8.08	7.79	+0.29	0.0841
94.30	13.08	12.65	+0.43	0.1849
142.31	14.00	14.23	−0.23	0.0529
215.50	15.00	15.35	−0.35	0.1225
			+1.44−0.85	1.0357
			=+0.59	
			P. E.=±0.31	

Table XLV

Results of the application of T.N.N. I and II to data obtained
by Herzog in the decomposition of ethyl
acetate with liver lipase

	Herzog's result				I $\begin{cases}K=0.006347 \\ k'=0.58321\end{cases}$			II $\begin{cases}K=0.140987 \times 10^{-3} \\ k'=0.61090\end{cases}$		
t (mins.)	cc. $N/20$ NaOH	$x(\%)$	$K_1 \cdot 10^5$	K_S	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
5	0.45	3.5	2.81	1.6	3.7	-0.2	0.04	3.6	-0.1	0.01
10	0.75	5.8	5.89	1.8	5.5	$+0.3$	0.09	5.4	$+0.4$	0.16
15	0.90	7.0	8.10	1.8	6.8	$+0.2$	0.04	6.9	$+0.1$	0.01
20	1.00	7.8	1.39	1.7	8.1	-0.3	0.09	8.1	-0.3	0.09
30	1.30	10.1	2.85	1.8	10.0	$+0.1$	0.01	10.1	0.0	0.00
$45\frac{1}{4}$	1.65	12.8	4.40	1.9	12.6	$+0.2$	0.04	12.6	$+0.2$	0.04
60	1.85	14.4	5.45	1.9	14.4	-0.3	0.09	14.7	-0.3	0.09
	.					$+0.8-0.8=0$	0.40		$0.7-0.7=0$	0.40
						P. E. $=\pm0.2$			P.E.$=0.2$	

$$K_1 = \frac{1}{t} \log \frac{a}{a-x}; \quad K_S = \frac{x}{\sqrt{t}}$$

Table XLVI

Data obtained by Kastle, Johnston and Elvolve in the
decomposition of ethyl butyrate, and the result of
the application of the $1\frac{1}{2}$ molecular equation

$x=$cc. of $N/20$ Na$_2$CO$_3$; $a=4.71$ cc. of $N/20$ Na$_2$CO$_3$; 21°C.				
t (mins.)	$x_{(exp)}$	$x_{(cal)}$	$10 \cdot 5 K = \frac{10^5}{t} \log \frac{a}{a-x}$	$x_{(exp)} - x_{(cal)}$
30	0.95	0.74	751	$+0.21$
60	1.30	1.31	538	-0.01
64	1.45	1.39	575	$+0.06$
97	1.80	1.87	496	-0.07
121	2.05	·2.16	472	-0.11
132	2.25	2.28	492	-0.03
198	2.75	2.84	443	-0.09
204	2.90	2.88	469	$+0.02$
361	3.50	3.75	376	-0.25
467	3.80	3.80	352	0.00
				$+0.29-0.56=-0.27$ mean $\pm0.086(\pm1.83\%)$

TABLE XLVII

Results of the application of T.N.N. I to data obtained by
KASTLE, JOHNSTON and ELVOLVE given in TABLE XLVI

t (mins.)	x (%)	I $\begin{cases} K=0.0029047 \\ k'=0.92955 \end{cases}$			$(t:30\sim204)$ I $\begin{cases} K=0.0013231 \\ k'=1.11216 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
30	20.17	14.62	+5.55	30.8025	12.50	+7.67	58.8289
60	27.60	25.98	+1.62	2.6244	25.12	+2.48	6.1504
64	30.79	27.37	+3.42	11.6964	26.67	+4.12	16.9744
97	38.22	37.53	+0.69	0.4761	38.98	−0.76	0.5776
121	43.52	43.88	−0.36	0.1296	46.81	−3.29	10.8241
131	47.77	46.31	+1.46	2.1316	49.82	−2.05	· 4.2025
198	58.39	59.87	−1.48	2.1904	66.43	−8.04	64.6416
204	61.57	60.88	+0.69	0.4761	67.65	−6.08	36.9664
361	74.31	79.72	· −5.41	29.2681	——	——	——
467	80.68	86.83	−6.15	37.8225	——	——	——
			+13.43−13.40 =+0.03 P. E.=±2.43	117.6177		+14.27−20.22 =−5.95 P. E.=3.60	199.1659

TABLE XLVIII

Results of the application of T.N.N. II to the data obtained by
KASTLE, JOHSTON and ELVOLVE given in TABLE XLVI

t (mins.)	x (%)	II $\begin{cases} K=0.55570\times10^{-4} \\ k'=1.05559 \end{cases}$			$(t:60\sim467)$ II $\begin{cases} K=0.37171\times10^{-4} \\ k'=1.13092 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
30	20.17	16.76	+3.41	11.6281	——	——	——
60	27.60	29.51	−1.91	3.6481	27.60	0	0
64	30.79	30.95	−0.16	0.0256	29.08	+1.71	2.9241
97	38.22	41.01	−2.79	7.7841	39.62	−1.40	1.9600
121	43.52	46.75	−3.23	10.4329	45.73	−2.21	4.8841
131	47.77	49.04	−1.27	1.6129	47.97	−0.20	0.0400
198	58.39	59.62	−1.23	1.5129	59.52	−1.13	1.2769
204	61.57	60.37	+1.20	1.4400	60.34	+1.23	1.5129
361	74.31	73.57	+0.74	0.5476	74.36	−0.05	0.0025
467	80.68	78.51	+2.17	4.7089	79.51	+1.17	1.3689
			+7.52−10.59 =−3.07 P. E.=±1.48	43.3411		+4.11−4.99 =−0.88 P. E.=±0.89	13.9694

Table XLIX

Data obtained by Euler in the decomposition of ethyl butyrate,
and the result of the application of monomolecular law

t (mins.)	0	2	6	9	16
$a-x$	2.7	2.4	1.95	1.65	1.05
$K \cdot 10^4$	—	256	235	237	250

Table L

Results of the application of T.N.N. I and II to data obtained
by Euler given in the previous table taking
2.7 as the value of a

t (mins.)	x	I $\begin{cases} K=0.2478 \\ k'=0.99033 \end{cases}$			II $\begin{cases} K=0.018848 \\ k'=1.19394 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
2	0.30	0.29	+0.01	0.0001	0.28	+0.02	0.0004
6	0.75	0.78	−0.03	0.0009	0.81	−0.06	0.0036
9	1.05	1.08	−0.03	0 0009	1.11	−0.06	0.0036
16	1.65	1.60	+0.05	0.0025	1.25	+0.09	0.0081
			+0.06−0.06=0	0.0044		+0.11−0.12 =−0.01	0.0157
			P. E.=±0.2			P. E.=±0.5	

Table LI

Results of the application of T.N.N. I and II to data obtained
by Rona and Ebsen in the decomposition of
tributyrin with 1 cc. of blood

t (mins.)	x	K_1^*	I $\begin{cases} K=0.0031901 \\ k'=0.95427 \end{cases}$			II $\begin{cases} K=0.62217 \times 10^{-4} \\ k'=1.07593 \end{cases}$		
	Rona's result		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
20	10.5	0.0027	10.4	+0.1	0.01	10.3	+0.2	0.04
30	14.5	0.0027	14.9	−0.4	0.16	15.0	−0.5	0.25
40	19.0	0.0027	19.0	0.0	0.0	19.2	−0.2	0.04
50	23.5	0.0027	22.8	+0.7	0.49	23.0	+0.5	0.25
60	26.5	0.0026	26.5	0.0	0.0	26.5	0.0	0.0
70	29.5	0.0026	29.8	−0.3	0.09	29.6	−0.1	0.01
				+0.8−0.7= +0.1 P. E.=±0.3	0.75		+0.7−0.8=−0.1 P. E.=±0.2	0.59

$*K_1 = \dfrac{1}{t} \log \dfrac{a}{a-x}$

TABLE LII

Results of toe application of T.N.N. II to data obtained
by RONA and EBSEN in the decomposition of
tributyrin with 2 cc. of blood

RONA's result				I $\begin{cases} K=0.0044014 \\ k'=1.04142 \end{cases}$			II $\begin{cases} K=0.547875 \times 10^{-4} \\ k'=1.32113 \end{cases}$		
t (mins.)	$\frac{x}{1}$ $\frac{}{a}$	x	$K=\frac{1}{t}\log\frac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
20	69.3	17.5	0.0050	17.7	-0.2	0.04	17.2	0.0	0.00
30	61.0	25.5	0.0050	25.5	0.0	0.00	25.7	-0.2	0.04
40	53.0	33.5	0.0053	32.6	$+0.9$	0.81	33.1	$+0.4$	0.16
50	47.0	39.0	0.0052	38.8	$+0.2$	0.04	39.3	$+0.2$	0.04
60	42.5	44.0	0.0051	44.3	-0.3	0.09	44.5	-0.5	0.25
70	37.5	49.0	0.0052	49.4	-0.4	0.16	48.9	$+0.1$	0.01
			0.0052	$+1.1-0.9=+0.2$		1.14	$+0.7-0.7=0$		0.50
				P. E.$=\pm0.3$			P.E.$=\pm0.2$		

TABLE LIII

The best applicable equation for each kind of
lipase and substrate

Enzyme	Substrate	Equation
Castor bean lipase	Soy bean oil	T.N.N. I
,,	Cotton seed oil	,,
,,	Olive oil	,,
,,	Castor bean oil	,,
,,	Triacetin	,,
Papain lipase	Soy bean oil	T.N.N. II
,,	Olive oil	,,
Lipase from fly amanita	,,	,,
Stomach lipase	Egg-yolk	T.N.N. I
Pancreas lipase	,,	?
,,	Triacetin	?
,,	Synthesis of ester	T.N.N. I?
,,	Decomposition of ester	T.N.N. I
Liver lipase	Ethyl butyrate	T.N.N. II ?
Lipase of fatty tissue	,,	T.N.N. I
Blood lipase	Tributyrin, monobutyrin	T.N.N. I

Table LIV

Results of the application of T.N.N. I and II to data obtained
by Willstätter and Stoll with chlorophyllase

Willstätter's result			I $\begin{cases} K=0.025584 \\ k'=0.89267 \end{cases}$			II $\begin{cases} K=0.40085 \times 10^{-5} \\ k'=1.94655 \end{cases}$		
t (mins.)	x	$K_1 \cdot 10^2$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
15	45	7.52	48.4	−3.4	11.56	44.1	+0.9	0.81
30	75	8.68	70.7	+4.3	18.49	75.1	−0.1	0.01
60	91	7.55	90.0	+1.0	1.00	91.4	−0.4	0.16
120	98	6.17	99.0	−1.0	1.00	97.8	+0.2	0.04
				+5.3−4.4 =+0.9 P.E.=±2.2	32.05		+1.1−0.5 =+0.6 P.E.=±0.4	1.02

$$K_1 = \frac{1}{t} \ln \frac{a}{a-x}$$

Table LV

Results of the application of T.N.N. I and II to data obtained
by Karrer, Joos and Staub with lichenase

Warrer's result			I $\begin{cases} K=0.001202 \\ k'=0.78267 \end{cases}$			II $\begin{cases} K=0.14691 \times 10^{-4} \\ k'=0.92089 \end{cases}$		
t (mins.)	x	$\frac{10^6}{t} \log \frac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
105	9.3	403	10.0	−0.7	0.49	9.5	−0.2	0.04
225	18.0	383	17.5	+0.5	0.25	17.7	+0.3	0.09
345	24.4	353	23.5	+0.9	0.81	24.2	+0.2	0.04
465	30.6	342	28.7	+1.9	3.61	29.6	+1.0	1.00
1440	53.4	231	56.0	−2.6	6.76	54.3	−0.9	0.81
				+3.3−3.3 =0 P.E.=±1.2	11.92		+1.5−1.1 =+0.4 P.E.=±0.5	1.98

TABLE LVI

Results of the application of T.N.N. I and II to data
obtained by KARRER, JOOS and STAUB

KARRER's result			I $\begin{cases} K=0.0017515 \\ k'=0.80744 \end{cases}$			II $\begin{cases} K=0.14691 \times 10^{-4} \\ k'=0.92089 \end{cases}$		
t (mins.)	x	$\dfrac{10^6}{t}\log\dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
105	13.5	600	15.9	−2.4	5.76	15.0	−1.5	2.25
225	29.5	679	27.4	+2.1	4.41	28.1	+1.4	1.96
345	40.0	636	36.3	+3.7	13.69	37.9	+2.1	4.41
465	46.8	591	43.7	+3.1	9.61	45.5	+1.3	1.69
1440	71.3	377	76.1	−4.8	23.04	73.1	−1.8	3.24
			+8.9−7.2 =+1.7 P.E.=±2.5		56.51	+4.8−3.3 =+1.5 P.E.=±1.2		13.55

TABLE LVII

Results of the application of T.N.N. I and II to data
obtained by PRINGSHEIM and SEIFERT with
lichenase, omitting the 3rd datum

PRINGSHEIM's result			I $\begin{cases} A=0.0017775 \\ k'=0.90630 \end{cases}$			II $\begin{cases} K=0.14074 \times 10^{-4} \\ k'=1.09236 \end{cases}$		
t (mins.)	x (%)	$\dfrac{10^5}{t}\log\dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ_2	Calc. value	Diff. Δ	Δ^2
60	11.06	84.8	11.32	−0.26	0.0676	10.97	+0.09	0.0081
150	24.71	86.0	24.11	+0.60	0.3600	25.11	−0.40	0.1600
240	38.57	88.1	—	—	—	—	—	—
345	45.9	77.3	44.40	+1.50	2.2500	45.44	+0.46	0.2116
465	53.5	71.5	53.67	−0.17	0.0289	53.58	−0.08	0.0064
585	59.66	67.4	61.23	−1.57	2.4649	59.72	−0.06	0.0036
			+2.1−2.0 =+0.1 P.E.=±0.8		5.1714	+0.55−0.54 =+0.01 P.E.=±0.2		0.3897
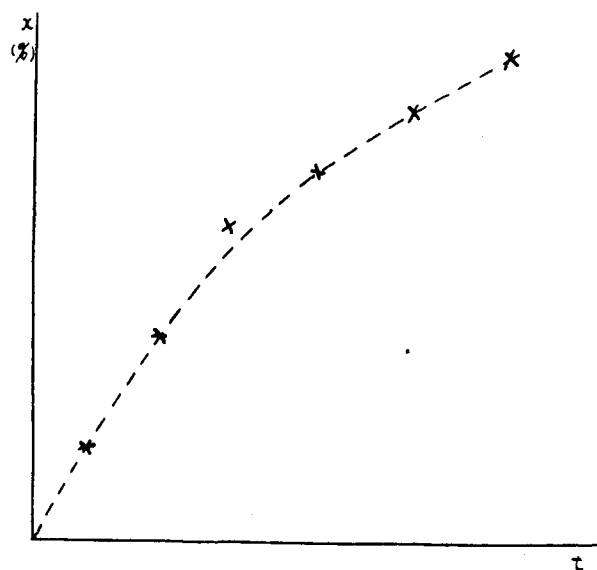
Fig. 1.

Experimental curve for data obtained by Pringsheim and
Seifert given in Table LVII

Table LVIII

Data obtained by Boselli with inulase

t (mins.)	Decomposition by buffer sol.	Decomposition by enzyme solution	$\dfrac{x}{a}$	$10^3 \cdot K = \dfrac{10^3}{t} \log \dfrac{a}{a-x}$
1.5	0.00	4.00	0.02	5.26
3	0.05	8.60	0.04	5.72
5	0.10	14.80	0.07	5.99
7	0.10	19.20	0.09	5.61
9	0.15	25.60	0.11	5.91
14	0.20	44.20	0.20	6.89
23	0.40	74.20	0.34	7.76
38	0.55	102.20	0.46	7.65
51	0.70	124.30	0.56	6.96

TABLE LIX

Results of the application of T.N.N. I and II to
data obtained by BOSELLI

BOSELLI's data		I $\begin{cases} K=0.0054575 \\ k'=1.07261 \end{cases}$			II $\begin{cases} K=0.10871\times10^{-3} \\ k'=1.19731 \end{cases}$		
t (hrs.)	x (%)	Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
1.5	2	1.9	+0.1	0.01	1.7	+0.3	0.09
3	4	4.0	0.0	0.00	3.9	+0.1	0.01
5	7	6.8	−0.2	0.04	6.9	+0.1	0.01
7	9	9.6	−0.6	0.36	10.0	−1.0	1.00
9	11	12.4	−1.4	1.96	13.1	−2.1	4.41
14	20	19.2	+0.8	0.64	20.4	−0.4	0.16
23	34	30.4	+3.6	12.96	31.7	+2.3	5.29
38	46	46.3	−0.3	0.09	45.9	+0.1	0.01
51	56	57.4	−1.4	1.96	54.6	+1.4	1.96
			+4.5−3.9 =+0.6 P.E.=±1.0	18.02		+4.3−3.5 =+0.8 P.E.=±0.9	12.94

TABLE LX

Results of the application of T.N.N. I and II to data obtained
by BOSELLI, omitting the 7th datum

t (hrs.)	x (%)	I $\begin{cases} K=0.0055175 \\ k'=1.05985 \end{cases}$			II $\begin{cases} K=0.111345\times10^{-3} \\ k'=1.18033 \end{cases}$		
		Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
1.5	2	1.9	+0.1	0.01	1.8	+0.2	0.04
3	4	4.0	0.0	0.00	3.9	+0.1	0.01
5	7	6.8	+0.2	0.04	6.9	+0.1	0.01
7	9	9.5	−0.5	0.25	10.0	−1.0	1.00
9	11	12.2	−1.1	1.21	12.9	−1.9	3.61
14	20	18.8	+1.2	1.44	20.0	0.0	0.00
23	34	—	—	—	—	—	—
38	46	45.1	+0.9	0.81	44.9	+1.1	1.21
51	56	55.9	+0.1	0.01	53.6	+2.4	5.76
			+2.5−1.6 =+0.9 P.E.=±0.5	3.77		+3.9−2.9 =+1.0 P.E.=±0.9	11.64

Table LXI

Results of the application of T.N.N. I and II to data obtained by Pringsheim and Perewosky, omitting the 4th datum

t (hrs.)	x	I $\begin{cases} K=0.8159\times10^{-3} \\ K'=0.96716 \end{cases}$			II $\begin{cases} K=0.082355\times10^{-5} \\ K'=0.95581 \end{cases}$		
		calc. value	Diff. Δ	Δ^2	calc. value	Diff. Δ	Δ^2
3	1.5	1.4	+0.1	0.01	1.5	0	0
8	4.2	3.5	+0.7	0.49	3.7	+0.5	0.25
24	8.5	10.0	−1.5	2.25	10.4	−1.9	3.61
72	23.1	—	—	—	—	—	—
114	39.2	42.0	−2.8	7.84	40.4	−1.2	1.44
138	47.9	49.6	−1.7	2.89	47.0	+0.9	0.81
162	57.0	56.8	+0.2	0.04	53.1	+3.9	15.21
			+1.0−5.0 =−4.0 P.E.=±1.1	13.52		+5.3−3.1 =+2.2 P.E.=±1.4	21.32

Table LXII

Results of the application of T.N.N. I and II to data obtained by Pringsheim and Leibowitz with cellobiase

t (hrs.)	x	I $\begin{cases} K=0.0078325 \\ K'=0.91677 \end{cases}$			II $\begin{cases} K=0.88546\times10^{-4} \\ K'=1.19244 \end{cases}$		
		calc. value	Diff. Δ	Δ^2	calc. value	Diff. Δ	Δ^2
24	27.8	28.3	−0.5	0.25	28.1	−0.3	0.09
48	48.4	46.6	+1.8	3.24	47.2	+1.2	1.44
72	58.5	59.7	−1.2	1.44	59.2	−0.7	0.49
			+1.8−1.7 =+0.1 P.E.=±1.1	4.93		+1.2−1.0 =+0.2 P.E.=±0.7	2.02

TABLE LXIII

Results of the application of T.N.N. I and II to data
obtained by PHILOCHE with Taka-diastase

PHILOCHE's result			I $\begin{cases} K=0.0034857 \\ k'=0.66585 \end{cases}$			II $\begin{cases} K=0.66270 \times 10^{-4} \\ k'=0.82132 \end{cases}$		
t (mins.)	x	$K \cdot 10^4= \dfrac{10^4}{t}\log\dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
21	6	12.3	5.9	+0.1	0.01	5.8	+0.2	0.04
51	11	10.0	10.4	+0.6	0.36	10.5	+0.5	0.25
113	15	6.2	17.0	−2.0	4.00	17.4	−2.4	5.76
224	26	5.8	25.4	+0.6	0.36	25.8	+0.2	0.04
390	36	5.0	34.7	+1.3	1.69	34.2	+1.8	3.24
				+2.6−2.0 =+0.6 P.E.=±0.9	6.42		+2.7−2.4 =+0.3 P.E.=±1.0	9.33

TABLE LXIV

Results of the application of T.N.N. I to data obtained
by PHILOCHE with Taka-diastase

PHILOCHE's result			I $\begin{cases} K=0.003122 \\ k'=0.63350 \end{cases}$			$(t:19\sim275)$ I $\begin{cases} K=0.003968 \\ k'=0.56944 \end{cases}$		
t (mins.)	x	$K \cdot 10^3= \dfrac{10^3}{t}\log\dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
19	5	11.7	4.5	+0.5	0.25	4.8	+0.2	0.04
39	7	7.9	7.1	−0.1	0.01	7.1	−0.1	0.01
55	8	6.6	8.7	−0.7	0.49	8.6	−0.6	0.36
208	18	4.1	19.1	−1.1	1.21	17.4	+0.6	0.36
275	20	3.5	22.3	−2.3	5.29	20.1	−0.1	0.01
453	34	3.7	29.3	+4.7	22.09	—	—	—
				+5.2−4.2 =+1.0 P.E.=±1.6	29.34		+0.8−0.8 =0.0 P.E.=±0.3	0.78

Table LXV

Results of the application of T.N.N. II to data obtained
by Philoche with Taka-diastase

PHILOCHE's data		I $\begin{cases} K=0.61851\times10^{-4} \\ k'=0.68535 \end{cases}$			II $\begin{cases} K=0.83744\times10^{-4} \\ k'=0.60441 \end{cases}$ $(t:19\sim275)$		
t (mins.)	x	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
19	5	4.4	+0.6	0.36	4.7	+0.3	0.09
39	7	7.1	−0.1	0.01	7.1	−0.1	0.01
55	8	8.8	−0.8	0.64	8.6	−0.6	0.36
208	18	19.3	−1.3	1.69	17.4	+0.6	0.36
275	20	22.5	−2.5	6.25	20.0	0.0	0.00
453	34	29.0	+5.0	25.00	—	—	—
			+5.6−4.7 =+0.9 P.E.=±1.8	33.95		+0.9−0.7 =+0.2 P.E.=±0.3	0.82

Table LXVI

Results of the application of T.N.N. I to data obtained
by Philoche with Taka-diastase

PHILOCHE's data		I $\begin{cases} K=0.0070568 \\ k'=0.52401 \end{cases}$ $(t:15\sim450)$			I $\begin{cases} K=0.0089928 \\ k'=0.46086 \end{cases}$ $(t:15\sim307)$		
t (mins.)	x	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
15	8	6.5	+1.5	2.25	7.0	+1.0	1.00
75	11	14.5	−3.5	12.25	14.1	−3.1	9.61
126	16	18.5	−2.5	6.25	17.5	−1.5	2.25
248	25	25.3	−0.3	0.09	23.1	+1.9	3.61
307	28	27.9	+0.1	0.01	25.2	+2.8	7.84
450	40	32.9	+7.1	50.41	—	—	—
			+8.7−6.3 =+2.4 P.E.=±2.5	71.26		+5.7−4.6 =+1.1 P.E.=±1.7	24.31

PHILOCHE's data		I $\begin{cases} K=0.00159963 \\ k'=0.79585 \end{cases}$ $(t:75\sim450)$			I $\begin{cases} K=0.0021013 \\ k'=0.73890 \end{cases}$ $(t:75\sim307)$		
t (mins.)	x	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
15	8	—	—	—	—	—	—
75	11	10.8	+0.2	0.04	11.1	−0.1	0.01
126	16	15.9	+0.1	0.01	15.8	+0.2	0.04
248	25	25.7	−0.7	0.49	24.8	+0.2	0.04
307	28	29.6	−1.6	2.56	28.3	−0.3	0.09
450	40	37.9	+2.1	4.11	—	—	—
			+2.4−2.3 =+0.1 P.E.=±0.9	7.51		+0.4−0.4=0 P.E.=±0.2	0.18

TABLE LXVII

Results of the application of T.N.N. I to data obtained
by HENRI with malz-amylase

HENRI's result				I $\begin{cases} K=0.78270\times10^{-3} \\ k\prime=0.99966 \end{cases}$			$(t:184\sim402)$ I $\begin{cases} K=0.9682\times10^{-3} \\ k\prime=0.96051 \end{cases}$		
t (mins.)	x (%)	$K=\dfrac{1}{t}\log\dfrac{a}{a-x}$		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
184	28.4	0.000788		28.2	+0.2	0.04	28.4	0.0	0.00
227	33.0	0.000766		33.5	−0.5	0.25	33.5	−0.5	0.25
326	44.6	0.000787		44.3	+0.3	0.09	43.9	+0.7	0.49
402	50.4	0.000757		51.5	−1.1	1.21	50.7	−0.3	0.09
467	57.8	0.000802		56.8	+1.0	1.00	——	——	——
					+1.5−1.6 =−0.1 P.E.=±0.5	2.59		+0.7−0.8 =−0.1 P.E.=±0.4	0.83

TABLE LXVIII

Results of the application of T.N.N. I to data obtained
by BROWN and GLENDINNING with malt extract

BROWN's result				I $\begin{cases} K=0.0030224 \\ k\prime=1.07994 \end{cases}$			$(t:10\sim60)$ I $\begin{cases} K=0.0031191 \\ k\prime=1.06958 \end{cases}$		
t (mins.)	x (%)	*1 K_m	*2 K_1	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
10	8.1	0.0037	0.0035	8.0	+0.1	0.01	8.1	0.0	0.00
20	16.3	0.0039	0.0036	16.2	+0.1	0.01	16.2	+0.1	0.01
30	23.8	0.0039	0.0035	24.0	−0.2	0.04	23.9	−0.1	0.01
40	30.8	0.0040	0.0035	31.2	−0.4	0.16	31.0	−0.2	0.04
44	33.4	0.0041	0.0034	33.9	−0.5	0.25	33.7	−0.3	0.09
50	37.8	0.0041	0.0035	37.9	−0.1	0.01	37.6	+0.2	0.04
60	44.0	0.0042	0.0034	44.0	0.0	0.00	43.6	+0.4	0.16
70	50.6	0.0044	0.0035	49.5	+1.1	1.21	——	——	——
					+1.3−1.2 =+0.1 P.E.=±0.3	1.69		+0.7−0.6 =+0.1 P.E.=±0.2	0.35

$*1 : K_m=\dfrac{1}{t}\log\dfrac{a}{a-x}$; $*2 : K_1=\dfrac{1}{t}\log\dfrac{a+x}{a-x}$

Table LXIX

Results of the application of T.N.N. I and II to data obtained by Henri with pancreas amylase

HENRI's result			I $\begin{cases} K=0.0013696 \\ k'=1.0145 \end{cases}$			II $\begin{cases} K=0.77965\times10^{-6} \\ k'=1.36830 \end{cases}$		
t (mins.)	x (%)	$\dfrac{10^5}{t}\log\dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
44	14.1	150	13.6	+0.5	0.25	12.1	+2.0	4.00
78	22.4	141	23.1	−0.7	0.49	23.2	−0.8	0.64
119	33.4	148	33.1	+0.3	0.09	35.0	−1.6	2.56
189	45.6	142	46.9	−1.3	1.69	49.8	−4.2	17.64
218	52.5	148	52.5	0.0	0.00	55.3	−2.8	7.84
385	75.2	157	73.4	+1.8	3.24	72.9	+2.3	5.29
484	80.4	146	81.2	−0.8	0.64	78.6	+1.8	3.24
				+2.6−2.8 =−0.2 P.E.=±0.7	6.40		+6.0−9.4 =−3.3 P.E.=±1.8	41.21

(t : 186 omitted) II $\begin{cases} K=0.536825\times10^{-5} \\ k'=1.44746 \end{cases}$		
Calc. value	Diff. Δ	Δ^2
11.4	+2.7	7.29
22.7	−0.3	0.09
35.2	−1.8	3.24
56.6	−4.1	16.81
74.8	+0.4	0.16
80.5	−0.1	0 01
	+3.1−6.3=−3.2 P.E.=±1.6	27.60

Table LXX

Results of the application of T.N.N. I and II to data obtained by Holmbergh

(i) For data obtained with starch

HOLMBERGH's result			I $\begin{cases} K=0.005229 \\ k'=0.81015 \end{cases}$			II $\begin{cases} K=0.55891\times10^{-4} \\ k'=1.04553 \end{cases}$		
t (mins.)	Maltose (mg)	$K_1\cdot10^4$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
60	26.9	34	27.2	−0.3	0.09	27.0	−0.1	0.01
90	36.0	34	35.6	+0.4	0.16	35.9	+0.1	0.01
170	51.6	33	51.8	−0.2	0.04	51.6	0.0	0.00
∞	96.3	—						
				+0.4−0.5=−0.1 P.E.±0.4	0.29		+0.1−0.1=0 P.E.=+0.1	0.02

96.3 was taken as the value of a ; $K_1=\dfrac{1}{t}\log\dfrac{a}{a-x}$

(ii)   For data obtained with glycogen

HOLMBERG's result				$II\begin{cases}K=0.70203\times 10^4\\k\prime=0.93351\end{cases}$			(4th datum omitted) $II\begin{cases}K=0.70997\times 10^{-4}\\k\prime=0.92968\end{cases}$		
t (mins.)	Maltose (mg)	x (%)	$K_1\cdot 10^4$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
60	22.0	24.2	26	24.4	−0.2	0.04	24.2	0.0	0.00
106	33.6	35.3	26	35.4	−0.1	0.01	35.2	0.0	0,00
119	35.7	37.5	25	37.9	−0.4	0.16	37.6	−0.1	0.01
142	40.7	42.7	25	41.8	+0.9	0.81	——	——	——
456	64.6	67.8	22	48.0	−0.2	0.04	67.8	0.0	0.00
					+0.9−0.9=0	1.06		−0.1	0.01
					P.E.=±0.3			P.E.=±0.0	

$$K_1=\frac{1}{t}\ \log\ \frac{a}{a-x}$$

TABLE LXXI

The best applicable equation for each kind of
amylase and substrate

Enzyme	Substrate	Author	Equation
Taka-diastase	Starch	PHILOCHE	T.N.N. I
Malt-amylase	,,	HENRI	T.N.N. I
,,	,,	BROWN and GLENDINNING	?
Pancreas amylase	,,	HENRI	T.N.N. I
Liver amylase	Starch, glycogen	HOLMBERGH	T.N.N. II

TABLE LXXII

Results of the application of T.N.N. I and II to data obtained
by WILLSTÄTTER, OPPENHEIMER and STEIBELT with maltase

WILLSTÄTTER's result				I $\begin{cases} K=0.027176 \\ k'=0.54280 \end{cases}$			II $\begin{cases} K=0.41575 \times 10^{-3} \\ k'=0.72980 \end{cases}$		
t (mins.)	Polarized degree	x (%)	$\dfrac{10^4}{t} \log \dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
10	1.23	19.2	93	19.6	−0.4	0.16	18.2	+1.0	1.00
20	1.72	26.9	68	27.2	−0.3	0.09	27.0	−0.1	0.01
30	2.16	33.8	60	32.7	+1.1	1.21	33.2	+0.6	0.36
40	2.41	37.7	52	37.1	+0.6	0.36	38.0	−0.3	0.09
60	2.81	44.0	42	43.9	+0.1	0.01	45.2	−1.2	1.44
80	3.13	49.0	37	49.1	−0.1	0.01	50.4	−1.4	1.96
100	3.41	53.2	33	53.3	−0.1	0.01	54.5	−1.3	1.69
150	3.92	61.2	27	61.3	−0.1	0.01	61.7	−0.5	0.25
200	4.25	66.4	24	67.1	−0.7	0.49	66.5	−0.1	0.01
300	4.78	75.0	20	74.9	+0.1	0.01	72.8	+2.2	4.84
					+1.9−1.7 =+0.2 P.E.=±0.4	2.36		+3.8−4.9 =−1.1 P.E.=±0.8	11.65

TABLE LXXIII

Results of the application of T.N.N. I and II to data obtained
by PHILOCHE in the decomposition of maltose
with Taka-diastase

PHILOCHE's result				I $\begin{cases} K=0.6544 \times 10^{-3} \\ k'=1.13335 \end{cases}$			II $\begin{cases} K=0.16583 \times 10^{-5} \\ k'=1.58674 \end{cases}$		
t (mins.)	x (%)	$*K.10^5$	$K_1.10^3$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
51	9.8	88	23	9.8	0.0	0.00	7.8	+2.0	4.00
112	19.8	86	22	22.2	−2.4	5.76	22.8	−3.0	9.00
175	33	103	22	34.1	−1.1	1.21	37.5	−4.5	20.25
230	49	127	26	43.4	+5.6	31.36	48.1	+0.9	0.81
349	61	120	25	59.8	+1.2	1.44	64.7	−3.7	13.69
469	76	134	24	72.0	+4.0	16.00	74.2	+1.8	3.24
588	81	122	22	80.7	+0.3	0.09	80.4	+0.6	0.36
903	90	107	22	93.1	−3.1	9.61	89.0	+1.0	1.00
			mean 23		+11.1−6.6 =+4.5 P.E=±2.1	65.47		+6.3−11.2 =−4.9 P.E.=±1.8	52.35

$$* \ K = \frac{1}{t} \log \frac{a}{a-x} \ : \ K_1 = \frac{a}{t}\left(\frac{2x}{a} + \ln \frac{a}{a-x} \right)$$

Table LXXIV

Results of the application of T.N.N. I and II to data obtained
by Willstätter, Kuhn and Sobotka in the decomposition
of α-methyl glucoside

Willstätter's result				$I\begin{cases}K=0.006974\\k\prime=0.69164\end{cases}$			$(t:30\sim240)$ $I\begin{cases}K=0.0063504\\k\prime=0.71444\end{cases}$			$II\begin{cases}K=0.99724\times10^{-4}\\k\prime=0.84662\end{cases}$		
t (mins.)	Polarized degree	x (%)	$\dfrac{10^4}{t}\log\dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
30	0.74	24.8	23.2	15.5	−0.7	0.49	15.3	−0.5	0.25	15.1	−0.3	0.09
60	1.24	24.8	20.6	23.9	+0.9	0.81	23.9	+0.9	0.81	24.2	+0.6	0.36
120	1.83	36.6	16.5	35.6	+1.0	1.00	36.1	+0.5	0.25	36.5	+0.1	0.01
180	2.25	45.0	14.5	44.2	+0.8	0.64	45.0	0.0	0.00	44.7	+0.3	0.09
240	2.55	51.0	12.9	50.9	+0.1	0.01	52.0	−1.0	1.00	50.8	+0.2	0.04
320	2.80	56.0	11.1	58.0	−2.0	4.00	—	—	—	56.8	−0.8	0.64
					$+2.8-2.7$ $=+0.1$ P.E.$=\pm0.8$	6.95		$+1.4-1.5$ $=-0.1$ P.E.$=\pm0.6$	2.31		$+1.2-1.1$ $=+0.1$ P.E.$=+0.4$	1.23

Table LXXV

Results of the application of T.N.N. I and II to data obtained
by Willstätter, Kuhn and Sobotka in the decomposition
of α-ethyl glucoside

Willstätter's result			$I\begin{cases}K=0.0015073\\k\prime=1.04273\end{cases}$			$II\begin{cases}K=0.67476\times10^{-5}\\k\prime=1.39238\end{cases}$		
t (mins.)	x (%)	$\dfrac{10^4}{t}\log\dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
60	18.8	15.0	17.9	+0.9	0.81	16.8	+2.0	4.00
120	33.0	14.5	33.4	−0.4	0.16	34.6	−1.6	2.56
180	45.2	14.5	46.2	−1.0	1.00	48.2	−3.0	9.00
240	55.2	14.5	56.7	−1.5	2.25	58.2	−3.0	9.00
300	65.2	15.3	65.2	0.0	0.00	65.5	−0.3	0.09
420	78.6	15.9	77.7	+0.9	0.81	75.2	+3.4	11.56
				$+1.8-2.9$ $=+1.1$ P.E.$=\pm0.7$	5.03		$+5.4-7.9$ $=-2.5$ P.E.$=\pm1.8$	36.21

TABLE LXXVI

Results of the application of T.N.N. I and II to data obtained
by WILLSTÄTTER and STEIBELT in the decomposition
of α-phenyl glucoside

WILLSTÄTTER's result			$I\begin{cases}K=0.010183\\ k'=0.62558\end{cases}$			$(t:30\sim275)$ $I\begin{cases}K=0.0083075\\ k'=0.67358\end{cases}$		
t (mins.)	x (%)	$\dfrac{10^4}{t}\log\dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
30	16.8	26.5	17.9	−1.1	1.21	17.2	−0.4	0.16
70	29.0	21.2	28.4	+0.6	0.36	28.4	+0.6	0.36
120	38.8	17.8	37.4	+1.4	1.96	38.2	+0.6	0.36
195	49.9	15.0	47.0	+2.9	8.41	48.7	+1.2	1.44
275	55.0	12.6	54.5	+0.5	0·25	56.8	−1.8	3.24
450	62.0	9.0	65.7	−3.7	13.69	——	——	——
				+5.4−4.8 =+0.6 P.E.=±1.5	25.88		+2.4−2.2 =+0.2 P.E.=±0.8	5.56

$II\begin{cases}K=0.14368\times10^{-3}\\ k'=0.78786\end{cases}$			$(t:30\sim275)$ $II\begin{cases}K=0.12220\times10^{-3}\\ k'=0.82604\end{cases}$		
Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
17.3	−0.5	0.25	16.9	−0.1	0.01
29.0	0.0	0.00	29.0	0.0	0.00
38.4	+0.4	0.16	38.9	−0.1	0.01
47.8	+1.9	3.61	48.8	+1.1	1.21
54.5	+0.5	0.25	55.8	−0.8	0.64
63.9	−1.9	3.61	——	——	——
	+2.8−2.4=+0.4 P.E.=±0.8	7.88		+1.1−1.0=+0.1 P.E.=±0.5	1.87

TABLE LXXVII

The best applicable equation for each kind of
maltase and substrate

Maltase of	Substrate	Equation
Bottom yeast	α-Methyl glucoside	T.N.N. II
Taka-diastase	Maltose	
Löwenbräu yeast	,,	T.N.N. I
,,	α-Ethyl glucoside	T.N.N. I
,,	α-Phenyl glucoside	T.N.N. II

TABLE LXXVIII

Result of the application of T.N.N. I to data obtained by
HERZOG in the decompostion of salicin with emulsin

HERZOG's result				$\begin{cases} K=0.006635 \\ k'=0.81692 \end{cases}$		
t (mins.)	x (%)	$10^5.\ K=\dfrac{10^5}{t}\log\dfrac{a}{a-x}$	$K_4 \cdot 10^5$	Calc. value	Diff. Δ	Δ^2
24	17.4	345	147	18.5	−1.1	1.21
54	35.1	348	158	32.8	+2.3	5.29
86	45.0	302	143	44.1	+0.9	0.81
210	69.1	243	133	70.0	−0.9	0.81
270	77.5	240	140	77.3	+0.2	0.04
371	84.7	220	137	85.3	−0.6	0.36
					+3.4−2.6	8.52
					=+0.8	
					P.E.=±0.9	

Table LXXIX

Result of the application of T.N.N. I to data obtained
by Willstätter and Oppenheimer in the
decomposition of arbutin

t (mins.)	x (%)	$K.\, 10^4 = \dfrac{10^4}{t} \log \dfrac{a}{a-x}$	$I \begin{cases} K=0.0038031 \\ k'=0.99472 \end{cases}$		
			Calc. value	Diff. Δ	Δ^2
40	29.2	375	29.07	+0.13	0.0169
65	41.9	363	42.69	−0.79	0.6241
95	57.0	387	55.61	+1.39	1.9321
125	64.8	363	65.60	−0.80	0.6400
175	77.6	371	77.49	+0.11	0.0121
				+1.63−1.59=+0.04 P.E.=±0.6	3.2252

Table LXXX

Results of the application of T.N.N. 1 and II to data obtained
by Willstätter and Oppenheimer in the decomposition
of β-methyl glucoside

t (hrs.)	x (%)	$\dfrac{10^4}{t} \log \dfrac{a-x}{a}$	$I \begin{cases} K=0.016117 \\ k'=1.02447 \end{cases}$			$II \begin{cases} K=0.28135\times10^{-3} \\ k'=1.32729 \end{cases}$		
			Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
2	7.1	370	7.27	−0.17	0.0289	6.6	+0.5	0.25
16	48.35	410	47.03	+1.32	1.7424	52.7	−4.35	18.9225
23	62.0	420	60.21	+1.79	3.2041	64.4	−2.4	5.76
41	81.0	400	81.10	−0.1	0.0100	79.5	+1.5	2.25
48	84.2	380	85.89	−1.69	2.8561	82.9	+1.3	1.69
				+3.11−1.87 =+1.24 P.E.=±1.1	7.8415		+3.3−6.75 =−3.45 P.E.=±1.9	28.8725

TABLE LXXXI

Results of the application of T.N.N. I and II to data obtained
by WILLSTÄTTER and OPPENHEIMER in the decomposition
of β-phenyl glucoside

WILLSTÄTTER's result			I $\begin{cases} K = 0.0017116 \\ k' = 1.04858 \end{cases}$			II $\begin{cases} K = 0.13069 \times 10^{-4} \\ k' = 1.35958 \end{cases}$		
t (mins.)	x (%)	$\dfrac{10^4}{t} \log \dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
45	19.5	209	19.2	+0.3	0.09	18.8	+0.7	0.49
133	46.8	203	47.8	−1.0	1.00	50.2	−3.4	11.56
180	60.0	221	59.9	+0.1	0.01	60.4	−0.4	0.16
225	69.6	225	68.5	+1.1	1.21	67.3	+2.3	5.29
				+1.5−1.0 =+0.5 P.E.=±0.6	2.31		+3.0−3.8 =−0.8 P.E.=±1.6	17.50

TABLE LXXXII

Result of the application of T.N.N. I to data obtained by
WILLSTÄTTER and OPPENHEIMER in the
decomposition of helicin

WILLSTÄTTER's result			I $\begin{cases} K = 0.0083324 \\ k' = 0.81819 \end{cases}$		
t (mins.)	x (%)	$\dfrac{10^4}{t} \log \dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2
5	7.0	273	6.91	+0.09	0.0081
12	13.6	230	14.34	−0.77	0.5929
36	29.2	181	30.23	−1.03	1.0609
80	51.0	168	49.94	+1.06	1.1236
				+1.15−1.80=−0.65 P.E.=±0.7	2.7855

TABLE LXXXIII

Result of the application of T.N.N. I to data obtained by
WILLSTÄTTER and CSÁNYI in the decomposition of raffinose

t (hrs.)	$KMnO_4$ (cc. of 0.154 N)	x (%)	$\dfrac{10^4}{t} \log \dfrac{a}{a-x}$	I $\begin{cases} K=0.015078 \\ k\prime=1.00137 \end{cases}$		
				Calc. value	Diff. Δ	Δ^2
1.0	0.5	3.5	351	3.4	+0.1	0.01
2.5	1.15	8.5	355	8.3	+0.2	0.04
6.0	2.5	18.0	330	18.8	−0.8	0.64
9.0	3.5	25.6	328	26.9	−1.3	1.69
22.5	7.3	55.2	350	54.4	+0.8	0.64
26.0	8.0	60.5	356	59.4	+1.1	1.21
30.5	8.7	66.0	352	65.5	+0.5	0.25
					2.7−2.1=+0.6 P.E.=±0.6	4.48

TABLE LXXXIV

Results of the application of T.N.N. I to data obtained by
NELSON and HITCHCOCK with invertase

NELSON's result			I $\begin{cases} K=0.0021954 \\ k\prime=1.10309 \end{cases}$			$(t: 5\sim120)$ I $\begin{cases} K=0.0023765 \\ k\prime=1.07663 \end{cases}$		
(t mins.)	t (calc.)	P (%)	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
5	4.96	3.15	2.94	+0.21	0.0441	3.04	+0.11	0.0121
10	10.1	6.35	6.21	+0.14	0.0196	6.34	+0.01	0.0001
15	14.9	9.38	9.53	−0.15	0.0225	9.61	−0.23	0.0529
22	22.1	13.77	14.18	−0.41	0.1681	14.15	−0.38	0.1444
30	30.1	18.52	19.37	−0.85	0 7225	19.19	−0.67	0.4489
60	60.1	35.43	37.03	−1.60	2.5600	36.20	−0.77	0.5929
90	89.8	50.27	51.49	−1.22	1.4884	50.10	+0.17	0.0289
120	119.6	62.73	62.98	−0.25	0.0625	61.23	+1.50	2.2500
180	180.6	80.30	78.86	+1.44	2.0736	———	———	———
300	299.9	94.48	93.48	+1.00	1.0000	———	———	———
				+2.79−4.51 =+1.72 P.E.=±0.64	8.1613		+1.79−2.05 =−0.26 P.E.=±0.48	3.5302

TABLE LXXXV

Result of the application of T.N.N. I to data obtained by EULER and KULLBERG

t (hrs.)	Polarized degree	x	$\dfrac{10^4}{t} \log \dfrac{a}{a-x}$	% for $100-0.3=99.7$	$I\begin{cases}K=0.007287\\k\prime=1.00853\end{cases}$ Calc. value	Diff. Δ	Δ^2
0	7.55	0.3	—	—	—	—	—
15	5.28	23.0	75	22.8	22.7	+0.1	0.01
24	4.20	33.8	74	33.6	33.9	−0.3	0.09
35	3.00	45.8	75	45.6	45.4	+0.2	0.04
∞	−2.42	100.0	—	—	—	—	—
						+0.3−0.3=0 P.E.=±0.2	0.14

TABLE LXXXVI

Result of the application of T.N.N. I to data obtained by WILLSTÄTTER and KUHN with raffinase

t (mins.)	Polarized degree	x (%)	$K_1 \cdot 10^4$	$I\begin{cases}K=0.0045113\\k\prime=0.94862\end{cases}$ Calc. value	Diff. Δ	Δ^2	(4th datum omitted) $I\begin{cases}K=0.004474\\k\prime=0.94927\end{cases}$ Calc. value	Diff. Δ	Δ^2
60	11.14	39.4	36.2	39.6	−0.2	0.04	39.4	0.0	0.00
80	10.55	48.4	39.5	48.5	−0.1	0.01	48.2	+0.2	0.04
110	9.80	60.0	36.2	59.2	+0.8	0.64	——	——	——
160	9.00	72.1	34.6	72.2	−0.1	0.01	71.9	−0.2	0.04
220	8.35	92.1	34.0	82.3	−0.2	0.04	82.0	+0.1	0.01
∞	7.18	100.0	—	—	—	—	—	—	—
					+0.8−0.6 =+0.2 P.E.=±0.3	0.74		+0.3−0.2 =+0.1 P.E.=±0.1	0.09

$$K_1 = \frac{1}{t} \log \frac{a}{a-x}$$

TABLE LXXXVII

Result of the application of T.N.N. I to data obtained by
COLIN and CHAUDAN with raffinase

COLIN's result			x	I $\begin{cases} K=0.003142 \\ k\prime=1.02525 \end{cases}$		
t (mins.)	Polarized degree	$\dfrac{10^5}{t} \log \dfrac{a}{a-x}$		Calc. value	Diff. Δ	Δ^2
0	13.71	—	—	—	—	—
10	13.26	310	0.45	0.48	−0.03	0.0009
20	12.76	340	0.95	0.94	+0.01	0.0001
30	12.30	352	1.41	1.37	+0.04	0.0016
45	11.67	362	2.04	1.97	+0.07	0.0049
60	11.14	362	2.57	2.49	+0.08	0.0064
80	10.55	359	3.16	3.11	+0.05	0.0025
110	9.80	362	3.91	3.87	+0.04	0.0016
160	9.00	346	4.71	4.78	−0.07	0.0049
220	8.35	340	5.36	5.48	−0.12	0.0144
∞	7.18	—				
					+0.29−0.22=+0.07 P.E.=±0.05	0.0374

$a=13.71-7.18=6.53$

TABLE LXXXVIII

Result of the application of T.N.N. I to data obtained by
WILLSTÄTTER and OPPENHEIMER with lactase

WILLSTÄTTER's result				I $\begin{cases} K=0.0171924 \\ k\prime=0.63256 \end{cases}$		
t (mins.)	Cu. (mg)	x (%)	$\dfrac{10^5}{t} \log \dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2
—	64.2	0	0	0	0	0
30	69.4	28	476	29	−1	1
52	71.9	37	386	38	−1	1
60	72.6	40	370	41	−1	1
70	73.9	43	349	44	−1	1
80	75.2	47	345	47	0	0
90	75.8	49	325	49	0	0
110	77.1	55	315	54	+1	1
135	78.8	62	311	59	+3	9
172	80.3	65	265	64	+1	1
210	81.8	69	243	69	0	0
270	83.3	73.5	214	74.5	−1	1
390	85.8	84	204	82	+2	4
550	87.3	87.5	182	88	−0.5	0.25
∞	(91.6)	(100)				
					+7−5.5=+1.5 P.E.=±1.0	20.25

TABLE LXXXIX

Results of the application of T.N.N. I to data obtained
by ARMSTRONG with lactase

ARMSTRONG's result			$I\begin{cases}K=0.018978\\k\prime=0.55337\end{cases}$			$(t:0.5-53)$ $I\begin{cases}K=0.019954\\k\prime=0.50817\end{cases}$		
t (mins.)	x (%)	$\dfrac{x}{\sqrt{t}}$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
0.5	3.2	4.5	3.0	+0.2	0.04	3.2	0.0	0.00
1.0	4.8	4.8	4.3	+0.5	0.25	4.5	+0.3	0.09
2.0	6.4	4.5	6.2	+0.2	0.04	6.3	+0.1	0.01
3.0	7.6	4.4	7.7	−0.1	0.01	7.7	−0.1	0.01
4.5	9.0	4.2	9.6	−0.6	0.36	9.4	−0.4	0.16
6.0	10.0	4.1	11.1	−1.1	1.21	10.8	−0.8	0.64
23	19.7	4.1	21.9	−2.2	4.84	20.2	−0.5	0.25
29	22.0	4.1	24.5	−2.5	6.25	22.4	−0.4	0.16
48	29.0	4.2	31.1	−2.1	4.41	28.0	+1.0	1.00
53	30.7	4.2	32.5	−1.8	3.24	29.2	+1.5	2.25
144	62.2	4.3	49.5	+12.7	161.29	——	——	——
				+13.6−10.4=+3.2 P.E.=±3.0	181.94		+2.9−2.2=+0.7 P.E.=±0.5	4.57

TABLE XC

Results of the application of T.N.N. I to data obtained
by ARMSTRONG with 0.4 g of emulsin

ARMSTRONG's result			$I\begin{cases}K=0.004339\\k\prime=0.87517\end{cases}$			$(t:1-70)$ $I\begin{cases}K=0.0042172\\k\prime=0.89549\end{cases}$		
t (hrs.)	x (%)	$K=\dfrac{1}{t}\log\dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
1	1.0	0.00440	1.0	0.0	0.00	1.0	0.0	0.00
2	1.8	0.00395	1.8	0.0	0.00	1.8	0.0	0.00
4	3.2	0.00352	3.3	−0.1	0.01	3.3	−0.1	0.01
6	4.5	0.00333	4.7	−0.2	0.04	4.7	−0.2	0.04
22	15.0	0.00320	13.9	+1.1	1.21	14.3	+0.7	0.49
46	25.5	0.00277	24.8	+0.7	0.49	25.9	−0.4	0.16
70	35.6	0.00271	34.3	+1.3	1.69	35.3	+0.3	0.09
167	54.7	0.00206	58.6	−3.9	15.21	——	——	——
				+3.1−4.2 =−1.1 P.E.=±1.1	18.65		+1.0−0.7 =+0.3 P.E.=±0.2	0.79

Table XCI

Result of the application of T.N.N. I to data obtained
by Armstrong with 0.1 g of emulsin

Armstrong's result			I $\begin{cases} K=0.0124634 \\ k\prime=0.70317 \end{cases}$		
t (hrs.)	x (%)	$K=\dfrac{1}{t}\log\dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2
1	3.1	0.0137	2.8	+0.3	0.09
2	4.6	0.0102	4.6	0.0	0.00
3	6.0	0.00896	6.0	0.0	0.00
4	7.0	0.00790	7.3	−0.3	0.09
6	8.8	0.00667	9.6	−0.8	0.64
22	21.5	0.00478	22.3	−0.8	0.64
46	34.7	0.00404	34.5	+0.2	0.04
70	46.0	0.00382	43.4	+2.6	6.76
				+3.1−1.9=+1.2	8.26
				P.E.=±0.7	

Table XCII

Result of the application of T.N.N. I to data obtained by
Willstätter and Csányi with emulsin

Willstätter's result			I $\begin{cases} K=0.017203 \\ k\prime=1.00023 \end{cases}$			(3rd datum omitted) I $\begin{cases} K=0.0.017220 \\ k\prime=1.00292 \end{cases}$		
t (hrs.)	x(%)	$K_1\cdot10^4$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
4	15	410	14.7	+0.3	0.09	14.7	+0.3	0.09
7	24	390	24.2	−0.2	0.04	24.4	−0.4	0.16
21	55	380	56.5	−1.5	2.25	—	—	—
24	61	390	61.4	−0.4	0.16	61.7	−0.7	0.49
30	69.5	396	69.6	−0.1	0.01	69.9	−0.4	0.16
46	85	410	83.9	+1.1	1.21	84.2	+0.8	0.64
				+1.4−2.2 =−0.8 P.E.=±0.7	3.75		+1.1−1.5 =−0.4 P.E.=±0.4	1.54

$$K_1=\frac{1}{t}\log\frac{a}{a-x}$$

TABLE XCIII

Results of the application of T.N.N. I to data obtained
by MIYAKE with mannase

	t (days)	x	I $\begin{cases} K=0.047263 \\ k/=1.05585 \end{cases}$		
			Calc. value	Diff. Δ	Δ^2
(i) $a=19.3$	3	5.7	5.7	0.0	0.00
	5	8.5	8.6	−0.1	0.01
	6	10.0	9.9	+0.1	0.01
	8	12.1	12.0	+0.1	0.01
	9	12.9	12.9	0	0
				+0.2−0.1=+0.1	0.03
				P.E.=±0.1	

	t (days)	x	I $\begin{cases} K=0.037002 \\ k/=0.61058 \end{cases}$		
			Calc. value	Diff. Δ	Δ^2
(ii) $a=20.7$	2	2.6	2.5	+0.1	0.01
	3	3.1	3.2	−0.1	0.01
	6	4.5	4.7	−0.2	0.04
	9	5.8	5.8	0.0	0.00
	10	6.2	6.1	+0.1	0.01
				+0.2−0.3=−0.1	0.07
				P.E.=±0.1	

	t (days)	x	I $\begin{cases} K=0.11047 \\ k/=0.59609 \end{cases}$		
			Calc. value	Diff. Δ	Δ^2
(iii) $a=7.9$	2	2.6	2.5	+0.1	0.01
	3	3.0	3.1	−0.1	0.01
	4	3.4	3.5	−0.1	0.01
	5	3.8	3.8	0.0	0.00
	7	4.4	4.4	0.0	0.00
	8	4.7	4.6	+0.1	0.01
				+0.2−0.2=0	0.04
				P.E.=±0.1	

	t (hrs.)	x	I $\begin{cases} K=0.20487 \\ k/=0.60622 \end{cases}$		
			Calc. value	Diff. Δ	Δ^2
(iv) $a=9.85$	2	5.2	5.0	+0.2	0.04
	3	5.9	5.9	0.0	0.00
	4	6.4	6.5	−0.1	0.01
	5	6.9	7.0	−0.1	0.01
	7	7.7	7.7	0.0	0.00
	8	8.0	8.0	0.0	0.00
	10	8.5	8.4	+0.1	0.01
				+0.3−0.2=+0.1	0.07
				P.E.=±0.1	

Table XCIV

Results of the application of T.N.N. I and II to data
obtained by Freudenberg with tannase

	t (mins.)	x (%)	I $\begin{cases} K=0.0024423 \\ k'=0.56858 \end{cases}$			II $\begin{cases} K=0.289733 \times 10^{-4} \\ k'=0.68724 \end{cases}$		
			Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
1.423 g digalloyl glucose	600	19.2	19.2	0.0	0.00	19.0	+0.2	0.04
	1440	29.9	29.6	+0.3	0.09	30.0	—0.1	0.01
	2880	40.0	40.6	—0.6	0.36	40.3	—0.3	0.09
	4320	48.5	48.1	+0.4	0.16	47.7	+0.8	0.64
	10080	74.0	—	—	—	—	—	—
				+0.7—0.6 =+0.1 P.E.=±0.3	0.61		+1.0—0.4 =+0.6 P.E.=±0.4	0.78

	t (mins.)	x (%)	I $\begin{cases} K=0.0012216 \\ k'=0.60873 \end{cases}$			II $\begin{cases} K=0.17310 \times 10^{-4} \\ k'=0.69393 \end{cases}$		
			Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
1.082 g gallic acid methyl ester	600	13.1	12.9	+0.2	0.04	12.8	+0.3	0.09
	1440	20.5	21.0	—0.5	0.25	21.2	—0.7	0.49
	2880	29.9	30.2	—0.3	0.09	30.3	—0.4	0.16
	4320	37.4	36.8	+0.6	0.36	36.6	+0.8	0.64
	10080	64.5	—	—	—	—	—	—
				+0.8—0.8 =0 P.E.=±0.3	0.74		+1.1—1.1 =0 P.E.=±0.5	1.38

Table XCV

Results of the application of T.N.N. II to data obtained
by Matsuyama and Nakamura with pepsin

Data obtained at 30°C.		II $\begin{cases} K=0.0027204 \\ k'=0.44812 \end{cases}$		
t (hrs.)	x (%)	Calc. value	Diff. Δ	Δ^2
1	21.30	21.39	—0.09	0.0081
2	27.35	27.07	+0.28	0.0784
3	30.40	30.80	—0.40	0.1600
4	33.95	33.62	+0.33	0.1089
5	36.00	35.88	+0.12	0.0144
6	37.55	37.78	—0.23	0.0529
		+0.73—0.72=+0.01 P.E.=±0.20		0.4227

(*To be continued*)

TABLE XCV

Results of the application of T.N.N. II to data obtained by
MATSUYAMA and NAKAMURA with pepsin—Continued

Data obtained at 37°C.		II $\begin{cases} K=0.0039685 \\ k'=0.47947 \end{cases}$		
t (hrs.)	x (%)	Calc. value	Diff. Δ	Δ^2
1	28.0	28.41	−0.41	0.1681
2	36.0	35.62	+0.62	0.7844
3	40.6	40.20	+0.40	0.1600
4	44.1	43.55	+0.55	0.3025
5	45.9	46.20	−0.30	0.0900
6	47.8	48.38	−0.58	0.3364 ·
			+1.57−1.29=+0.28	1.8414
			P.E. = ±0.41	

Data obtained at 42°C.		II $\begin{cases} K=0.0054956 \\ k'=0.49370 \end{cases}$		
t (hrs.)	x (%)	Calc. value	Diff. Δ	Δ^2
1	34.05	35.47	−1.42	2.0164
2	45.55	43.62	+1.93	3.7249
3	49.50	48.59	+0.91	0.8281
4	52.15	52.14	+0.01	0.0001
5	55.05	54.88	+0.18	0.0324
6	55.65	57.10	−1.45	2.1025
			+3.03−2.87=+0.16	8.7044
			P.F. = ±0.90	

Data obtained at 47°C.		II $\begin{cases} K=0.0074954 \\ k'=0.400545 \end{cases}$		
t (hrs.)	x (%)	Calc. value	Diff. Δ	Δ^2
1	41.70	42.84	−1.14	1.2996
2	50.35	49.73	+0.62	0.3844
3	55.70	53.79	+1.91	3.6481
4	57.10	56.63	+0.47	0.2209
5	58.20	58.79	−0.59	0.3481
6	59.40	60.57	−1.17	1.3689
			+3.00−2.90=+0.10	7.2700
			P.E. = ±0.81	

Data obtained at 52°C.		II $\begin{cases} K=0.0072523 \\ k'=0.27138 \end{cases}$		
t (hrs.)	x (%)	Calc. value	Diff. Δ	Δ^2
1	40.85	42.04	−1.19	1.4161
2	47.35	46.68	+0.67	0.4489
3	51.40	49.42	+1.98	3.9204
4	51.85	51.37	+0.48	0.2304
5	52.25	52.88	−0.63	0.3969
6	52.85	54.12	−1.27	1.6129
			+3.13−3.09=+0.04	8.0256
			P.E. = ±0.85	

K. NAKAJIMA and T. KAMADA

TABLE XCVI

Results of the application of T.N.N. I and II to data obtained by RONA and KLEINMANN with pepsin

(i)

(mins.)	x (%)	$\dfrac{10^5}{t}\dfrac{x}{a(a-x)}=K\cdot 10^5$	I $\begin{cases}K=0.0064779\\k'=0.79738\end{cases}$			II $\begin{cases}K=0.115755\times 10^{-3}\\k'=0.90986\end{cases}$		
			Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
15	11.5	8.67	1.21	−0.6	0.36	12.0	−0.5	0.25
30	21.3	9.00	20.1	+1.2	1.44	20.4	+0.9	0.81
45	27.6	8.45	26.7	+0.9	0.81	27.0	+0.6	0.36
60	32.5	8.04	32.3	+0.2	0.04	32.0	+0.5	0.25
90	40.0	7.44	41.7	−1.7	2.89	41.0	−1.0	1.00
		mean 8.32		+2.3−2.3 =0 P.E.=±0.8	5.54		+2.0−1.5 =+0.5 P.E.=±0.6	2.67

(ii)

t (mins.)	x (%)	$\dfrac{10^5}{t}\dfrac{x}{a(a-x)}=K\cdot 10^5$	I $\begin{cases}K=0.0043119\\k'=0.85468\end{cases}$			II $\begin{cases}K=0.079058\times 10^{-4}\\k'=0.95291\end{cases}$		
			Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
15	9.0	6.57	9.6	−0.6	0.36	9.5	−0.5	0.25
30	17.5	7.06	16.6	+0.9	0.81	16.8	+0.7	0.49
45	24.0	7.03	22.7	+1.3	1.69	22.9	+1.1	1.21
60	28.3	6.57	28.0	+0.3	0.09	28.1	+0.2	0.04
90	35.1	6.03	37.2	−2.1	4.41	36.5	−1.4	1.96
		mean 6.55		+2.5−2.7 =−0.2 P.E.=±0.9	7.36		+2.0−1.9 =+0.1 P.E.=±0.7	3.95

(iii)

t (mins.)	x (%)	$\dfrac{10^5}{t}\dfrac{x}{a(a-x)}=K\cdot 10^5$	I $\begin{cases}K=0.0069332\\k'=0.85487\end{cases}$			II $\begin{cases}K=0.98313\times 10^{-5}\\k'=1.04936\end{cases}$		
			Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
15	14.1	10.95	14.9	−0.8	0.64	14.4	−0.3	0.09
30	25.8	11.55	25.4	+0.4	0.16	25.9	−0.1	0.01
45	35.8	12.35	33.9	+1.9	3.61	34.8	+1.0	1.00
60	42.7	12.40	41.1	+1.6	2.56	41.9	+0.8	0.64
90	52.1	12.10	52.9	−0.8	0.64	52.5	−0.4	0.16
120	59.2	12.10	61.6	−2.4	5.76	59.9	−0.7	0.49
		mean 11.97		+3.9−4.0 =−0.1 P.E.=±1.1	13.37		+1.8−1.5 =+0.3 P.E.=±0.5	2.39

t (mins.)	$x(\%)$	$\dfrac{10^5}{t}\cdot\dfrac{x}{a(a-x)}=K\cdot10^5$	I $\begin{cases}K=0.00531775\\k'=0.82457\end{cases}$			II $\begin{cases}K=0.84938\times10^{-4}\\k'=0.96726\end{cases}$		
			Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
15	10.0	7.41	10.8	−0.8	0.64	10.4	−0.4	0.16
30	19.0	7.82	18.3	+0.7	0.49	18.6	+0.4	0.16
45	26.0	7.82	24.6	+1.4	1.96	25.2	+0.8	0.64
60	31.2	7.66	30.1	+1.1	1.21	30.8	+0.4	0.16
90	40.0	7.43	39.4	−0.6	0.36	39.7	+0.3	0.09
120	46.0	7.10	47.0	−1.0	1.00	46.6	−0.6	0.36
150	51.3	7.02	53.4	−2.1	4.41	52.0	−0.7	0.49
		mean 7.45		+3.2−4.5 =−1.3 P.E.=±0.9	10.07		+1.9−1.7 =+0.2 P.E.=±0.4	2.06

(iv)

t (mins.)	$x(\%)$	$\dfrac{10^5}{t}\cdot\dfrac{x}{a(a-x)}=K\cdot10^5$	I $\begin{cases}K=0.0053016\\k'=0.85776\end{cases}$			II $\begin{cases}K=0.76505\times10^4\\k'=1.03432\end{cases}$		
			Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
15	11.5	8.66	11.7	−0.2	0.04	11.2	+0.3	0.09
30	20.0	8.34	20.2	−0.2	0.04	20.5	−0.5	0.25
45	28.2	8.73	27.4	+0.8	0.64	28.2	0	0
60	33.9	8.52	33.6	+0.3	0.09	34.6	−0.7	0.49
90	44.6	8.98	44.0	+0.6	0.36	44.6	0.0	0.00
120	52.3	9.14	52.3	0.0	0.00	52.0	+0.3	0.09
150	58.0	9.20	59.3	−1.3	1.69	57.7	+0.3	0.09
		mean 8.80		+1.7−1.7 =0 P.E.=±0.5	2.86		+0.9−1.2 =−0.3 P.E.=±0.3	1.01

(v)

TABLE XCVII

Results of the application of T.N.N. I and II to data obtained
by Rona and Kleinmann with trypsin

(i) For data obtained with pancreatin (Rhenania), P_H 7.25

t (mins.)	$x\ (\%)$	I $\begin{cases}K=0.100977\\k'=0.32735\end{cases}$			II $\begin{cases}K=0.0020447\\k'=0.47865\end{cases}$		
		Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
15	43.2	43.1	+0.1	0.01	42.8	+0.4	0.16
30	51.3	50.7	+0.6	0.36	51.0	+0.3	0.09
60	57.2	58.9	−1.7	2.89	59.2	−2.0	4.00
90	64.2	63.7	+0.5	0.25	63.8	+0.4	0.16
120	67.7	67.2	+0.5	0.25	66.9	+0.8	0.64
			+1.7−1.7=0 P.E.=±0.7	3.76		+1.9−2.0 =−0.1 P.E.=±0.8	5.05

(ii)   For data obtained with pancreatin (Rhenania), P_H 7.78

t (mins.)	x (%)	I $\begin{cases} K=0.0013080 \\ k'=0.76367 \end{cases}$			II $\begin{cases} K=0.16332\times10^{-3} \\ k'=1.01555 \end{cases}$		
		Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
15	22.2	21.2	+1.0	1.00	20.4	+1.8	3.24
30	31.5	33.3	−1.8	3.24	34.1	−2.6	4.16
60	49.4	49.7	−0.3	0.09	51.1	−1.7	2.89
90	59.4	60.7	−1.3	1.69	61.2	−1.8	3.24
120	71.0	68.8	+2.2	4.84	67.9	+3.1	9.61
			+3.2−3.4 =−0.2 P.E.=±1.1	10.86		+4.9−6.1 =−1.2 P.E.=+1.6	23.14

(iii)   For data obtained with Pancreatin (Kraus), P_H 7.78

t (mins.)	x (%)	I $\begin{cases} K=0.0113045 \\ k'=0.68451 \end{cases}$			II $\begin{cases} K=0.19068\times10^{-3} \\ k'=0.82133 \end{cases}$		
		Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
15	16.4	15.3	+1.1	1.21	15.0	+1.4	1.96
30	21.3	23.4	−2.1	4.41	23.8	−2.5	·6.25
60	34.4	34.9	−0.5	0.25	35.5	−1.1	1.21
90	44.0	43.2	+0.8	0.64	43.3	+0.7	0.49
120	50.8	49.8	+1.0	1.00	49.3	+1.5	2.25
			2.9−2.6 =+0.3 P.E.=±0.9	7.51		+3.6−3.6=0 P.E.=±1.2	12.16

(iv)   For data obtained with pancreatin (Kraus), P_H 7.3

t (mins.)	x (%)	I $\begin{cases} K=0.057019 \\ k'=0.45718 \end{cases}$			II $\begin{cases} K=0.98210\times10^{-3} \\ k'=0.64696 \end{cases}$		
		Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
15	36.5	36.4	+0.1	0.01	36.2	+0.3	0.09
30	49.4	——	——	——	——	——	——
60	57.5	57.4	+0.1	0.01	58.1	−0.6	0.36
90	63.3	64.2	−0.9	0.81	64.3	−1.0	1.00
120	69.7	69.0	+0.7	0.49	68.5	+1.2	1.44
			+0.9−0.9=0 P E.=±0.4	1.32		+1.5−1.6 =−0.1 P.E.=±0.7	2.89

(v) For data obtained with pancreatin (Kraus), P_H 7.3

t (mins.)	x (%)	I $\{K=0.056169 \atop k'=0.39492\}$			II $\{K=0.0011059 \atop k'=0.52112\}$		
		Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
15	31.0	31.4	−0.4	0.16	31.2	−0.2	0.04
30	39.7	39.1	+0.6	0.36	39.4	+0.3	0.09
60	44.4	——	——	——	——		
90	53.9	53.5	+0.4	0.16	53.6	+0.3	0.09
120	56.9	57.5	−0.6	0.36	57.3	−0.4	0.16
			+1.0−1.0=0	1.04		+0.6−0.6=0	0.38
			P.E.=±0.4			P.E.=±0.2	

TABLE XCVIII

Data obtained by BAYLISS with sodium caseinate

t (mins.)	x (%)	Cal. value by ARRHENIUS's equation
0.5	35.5	35.7
1	48.0	46.7
2	59.2	58.4
4	67.5	68.1
6	71.4	72.6
8	74.2	74.8

TABLE XCIX

Results of the application of T.N.N. II to data obtained by

OSHIMA, $\quad K_1=\dfrac{1}{t}\log\dfrac{a}{a-x}\quad K_S=\dfrac{x}{\sqrt{t}}$

(i) Data obtained with peptone in the solution of P_H value 5.1

t (mins.)	x (%)	$K_1 \cdot 10^5$	$K_S \cdot 10^5$	II $\{K=0.7690\times10^{-4} \atop k'=0.80383\}$		
	OSHIMA's result			Calc. value	Diff. Δ	Δ²
60	16.62	7918	5800	17.13	−0.51	0.2601
120	27.40	6915	6700	26.51	+0.89	0.7921
180	34.10	6023	6870	33.33	+0.77	0.5929
240	38.13	5211	6650	38.64	−0.51	0.2601
360	46.05	4479	6560	46.52	−0.47	0.2209
				+1.66−1.49=+0.17		2.1261
				P.E.=±0.57		

(ii)   Data obtained with peptone in the solution of P_H value 5.3

	Oshima's result			II $\begin{cases}K=0.70913\times 10^{-4}\\ k'=0.83784\end{cases}$		
t (mins.)	x (%)	$K_1 \cdot 10^5$	$K_S \cdot 10^4$	Calc. value	Diff. Δ	Δ^2
60	17.65	8386	6160	17.97	-0.32	0.1024
120	27.95	7107	6880	28.14	-0.19	0.0361
180	37.20	6741	6480	35.49	$+1.71$	2.9241
240	41.35	5793	6200	41.17	$+0.18$	0.0324
360	48.30	4778	6900	49.57	-1.27	1.6129
					$+1.89-1.78=+0.11$ P.E.$=\pm 0.73$	4.7079

(iii)   Data obtained with peptone in the solution of P_H value 6.0

	Oshima's result			II $\begin{cases}K=0.8559\times 10^{-4}\\ k'=0.78628\end{cases}$		
t (mins.)	x (%)	$K_1 \cdot 10^5$	$K_S \cdot 10^4$	Calc. value	Diff. Δ	Δ^2
60	17.87	8529	6230	17.63	$+0.24$	0.0576
120	26.35	6836	6650	26.93	-0.58	0.3364
180	33.25	5727	6700	33.68	-0.43	0.1849
240	40.00	5542	6975	38.90	$+1.10$	1.2100
360	46.40	4480	6625	46.68	-0.28	0.0784
					$+1.34-1.29=+0.05$ P.E.$=\pm 0.56$	1.8673

(iv)   Data obtained with casein

	Oshima's result			I $\begin{cases}K=0.0063566\\ k'=0.74491\end{cases}$		
t (mins.)	x (%)	$K_1 \cdot 10^4$	$K_S \cdot 10^4$	Calc. value	Diff. Δ	Δ^2
60	26.55	2684	6040	26.58	-0.03	0.0009
120	38.97	2172	6267	40.42	-1.45	2.1025
180	48.25	1907	3340	50.36	-2.11	4.4521
240	63.28	1742	6440	58.02	$+5.26$	27.6676
1200	93.83	1208	4780	94.38	-0.55	0.3025
					$+5.26-4.03=+1.23$ P.E.$=\pm 1.98$	34.5256

(t:240 omitted) I $\begin{cases}K=0.0063129\\ k'=0.73943\end{cases}$			II $\begin{cases}K=0.14847\times 10^{-4}\\ k'=1.28703\end{cases}$		
Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
25.93	$+0.62$	0.3844	22.39	$+4.16$	17.3056
39.41	-0.44	0.1936	34.36	$+4.61$	21.2521
49.15	-0.90	0.8100	54.26	-6.01	36.1201
—	—	—	63.21	$+0.07$	0.0049
93.61	$+0.22$	0.0484	93.17	$+0.66$	0.4356
	$+0.84-1.34=-0.50$ P.E.$=\pm 0.47$	1.4364		$+9.50-6.01=+3.49$ P.E.$=\pm 2.92$	75.1183

TABLE C

Result of the application of T.N.N. I to data obtained by WEIS

WEIS's result					II $\begin{cases} K=0.60846\times10^{-3} \\ k'=0.54370 \end{cases}$		
t (hrs.)	x_1	x_2	mean	$K=\dfrac{x}{\sqrt{t}}$	Calc. value	Diff. Δ	$\Delta^2\times10^4$
1	5.80	5.34	5.57	5.6	5.74	−0.17	289
2	8.54	8.42	8.48	6.0	8.15	+0.33	1089
4	11.34	11.94	11.64	5.8	11.45	+0.19	361
6	13.32	13.70	13.51	5.5	13.88	−0.37	1369
					+0.51−0.54=−0.02 P.E.=±0.22		3108

TABLE CI

Result of the application of T.N.N. I to data obtained by DERNBY with ordinary yeast

DERNBY's result		$a=100$				$a=92$, I $\begin{cases} K=0.012852 \\ k'=0.78999 \end{cases}$			
t (hrs.)	x_1	K_S	K_A	K_{II}	K_D	$x_1=$ 100−8	Calc. value	Diff. Δ	Δ^2
0	8								
16	30	7.5	3.54	0.017	0.067	22	21	+1	1
40	45	7.13	3.70	0.011	0.067	37	39	−2	4
64	58	7.25	4.50	0.009	0·072	50	50	0	0
88	67	7.13	4.90	0.008	0.075	59	59	0	0
112	72	6.8	5.00	0.007	0.073	66	65	+1	1
							+2−2=0 P.E.=±1		6

TABLE CII

Result of the application of T.N.N. I and II to data obtained by DERNBY with treated yeast

DERNBY's result		$a=100$				$a=90$, I $\begin{cases} K=0.027877 \\ k'=0.72538 \end{cases}$				II $\begin{cases} K=0.28530\times10^{-3} \\ k'=1.12885 \end{cases}$		
t (hrs.)	x	K_S	K_A	K_{II}	K_D	$x_1=$ x−10	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
0	10											
16	45	11.3	9.12	0.021	0.105	35	34	+1	1	33	+2	4
40	63	10.1	9.54	0.016	0.110	53	55	−2	4	56	−3	9
64	75	9.4	9.94	0.013	0.106	65	66	−1	1	66	−1	1
88	84	9.0	11.36	0.012	0.113	74	73	+1	1	72	+2	4
							+2−3=−1 P.E.=±1		7		+4−4=0 P.E.=±2	18

TABLE CIII

Results of the application of T.N.N. I and II to data
obtained by ABDERHALDEN and FODOR in the
decomposition of glycyl-l-leucin

P_H 6.29 — I $\begin{cases} K=0.0056389 \\ k'=1.16040 \end{cases}$ II $\begin{cases} K=0.47391\times10^{-3} \\ k'=1.44079 \end{cases}$

t (mins.)	cc. of N/10 NaOH	x (mg)	$a-x$ (mg)	$\frac{x}{t}\cdot10^4$	$\frac{10^4}{t}\ln\frac{a}{a-x}$	$\frac{x}{\sqrt{t}}\cdot10^4$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
10	0.56	10.5	52.0	10.5	184	—	11.3	−0.8	0.64	10.5	0.0	0.00
20	1.19	22.4	40.0	(11.2)	(222)	—	21.4	+1.0	1.00	22.1	+0.3	0.09
30	1.58	29.9	32.6	9.9	217	—	30.6	−0.7	0.49	30.9	−1.0	1.00
40	2.02	38.0	24.5	9.5	234	—	38.0	0.0	0.00	37.3	+0.7	0.49
								+1.0−1.5=−0.5 P.E.=±0.6	2.13		+1−1=0 P.E.=±0.5	1.58

P_H 7.37 — I $\begin{cases} K=0.012176 \\ k'=0.99218 \end{cases}$ II $\begin{cases} K=0.24018\times10^3 \\ k'=1.31178 \end{cases}$

t (mins.)	cc. of N/10 NaOH	x (mg)	$a-x$ (mg)	$\frac{x}{t}\cdot10^4$	$\frac{10^4}{t}\ln\frac{a}{a-x}$	$\frac{x}{\sqrt{t}}\cdot10^4$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
10	0.81	15.2	47.3	25.6	279	25.6	15.0	+0.2	0.04	14.7	+0.5	0.25
20	1.37	25.8	36.7	30.6	266	30.6	26.4	−0.6	0.36	27.1	−1.3	1.69
30	1.87	35.2	27.3	34.1	276	34.1	34.9	+0.3	0.09	35.3	−0.1	0.01
40	2.21	41.6	20.9	34.9	273	34.9	41.5	+0.1	0.01	40.9	+0.7	0.49
								+0.6−0.6=0 P.E.=±0.3	0.50		+1.2−1.4 P.E.=±0.6	2.44

P_H 8.41 — I $\begin{cases} K=0.02863 \\ k'=0.86254 \end{cases}$ II $\begin{cases} K=0.4706\times10^{-3} \\ k'=1.30823 \end{cases}$

t (mins.)	cc. of N/10 NaOH	x (mg)	$a-x$ (mg)	$\frac{x}{t}\cdot10^4$	$\frac{10^4}{t}\ln\frac{a}{a-x}$	$\frac{x}{\sqrt{t}}\cdot10^4$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
10	1.25	23.5	39.0	—	472	39.5	23.8	−0.3	0.09	23.4	+0.1	0.01
20	1.98	37.2	25.3	—	401	44.3	36.4	+0.8	0.64	37.3	−0.1	0.01
30	2.36	44.5	18.0	—	415	43.2	44.4	+0.1	0.01	44.7	−0.2	0.04
40	2.62	49.3	13.2	—	389	41.2	49.7	−0.4	0.16	49.1	+0.2	0.04
								+0.9−0.7=+0.2 P.E.=+0.4	0.90		0.3−0.3=0 P.E.=±0.2	0.10

P_H 9.33 — I $\begin{cases} K=0.012718 \\ k'=0.83960 \end{cases}$ II $\begin{cases} K=0.36743\times10^{-3} \\ k'=0.98739 \end{cases}$

t (mins.)	cc. of N/10 NaOH	x (mg)	$a-x$ (mg)	$\frac{x}{t}\cdot10^4$	$\frac{10^4}{t}\ln\frac{a}{a-x}$	$\frac{x}{\sqrt{t}}\cdot10^4$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
10	0.62	11.6	50.9	—	205	36.7	11.4	+0.2	0.04	11.4	+0.2	0.04
20	0.98	18.4	44.1	—	174	41.2	18.9	−0.5	0.25	19.2	−0.8	0.64
30	1.35	25.4	37.1	—	174	24.6	24.9	+0.5	0.25	24.9	+0.5	0.25
								+0.7−0.5=+0.2 P.E.=±0.4	0.54		0.7−0.8=−0.1 P.E.=±0.5	0.93

TABLE CIV

Results of the application of T.N.N. I and II to data obtained
by EULER in the decomposition of glycyl-glycin

(i) For data obtained with 5 g erepsin prep. in 100 cc. of solution

	EULER's result			I $\begin{cases} K=0.000952 \\ k'=0.97401 \end{cases}$			II $\begin{cases} K=0.138156\times10^{-4} \\ k'=1.10505 \end{cases}$		
t (mins.)	1000 $(a-x)$	1000 x	$\dfrac{10^3}{t}\log\dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
0	930	——	——	——	——	—	——	——	—
7	837	93	6.54	94	−1	1	93	0	0
13	763	167	6.60	165	+2	4	168	−1	1
20	690	240	6.48	238	+2	4	244	−4	16
28	620	310	6.30	313	−3	9	317	−7	49
36	550	380	6.33	379	+1	1	378	+2	4
					+5−4=+1	19		+12−12=0	70
					P.E.=±2			P.E.=±3	

(ii) For data obtained with 4 g erepsin prep. in 100 cc. of solution

	EULER's result			I $\begin{cases} K=0.58281\times10^{-2} \\ k'=0.96725 \end{cases}$			II $\begin{cases} K=0.113526\times10^{-4} \\ k'=1.08903 \end{cases}$		
t (mins.)	1000 $(a-x)$	1000 x	$\dfrac{10^3}{t}\log\dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
0	950	——	——	——	——	—	——	——	—
8	861	89	5.36	91	−2	4	89	0	0
15	788	162	5.42	160	+2	4	162	0	0
25	696	254	5.40	248	+6	16	251	+3	9
36	617	333	5.21	332	+1	1	331	+2	4
43	579	371	5.00	380	−9	81	373	−2	4
					+9−11=−2	126		+5−2=+3	17
					P.E =±4			P.E.=±1	

(iii) For data obtained with 0.10 n glycyl-glycin

	EULER's result			I $\begin{cases} K=0.0080222 \\ k'=0.95589 \end{cases}$			II $\begin{cases} K=0.106465\times10^{-4} \\ k'=1.08033 \end{cases}$		
t (mins.)	1000 $(a-x)$	1000 x	$\dfrac{10^3}{t}\log\dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
0	915	——	——	——	——	—	——	——	—
7	813	102	7.35	102	0	0	101	+1	1
15	714	201	7.20	199	+2	4	202	−1	1
22	642	273	7.01	273	0	0	275	−2	4
30	569	346	6.87	347	−1	1	346	+3	9
					+2−1=+1	5		+4−3=+1	15
					P.E.−±1			P.E.=±2	

(iv) For data obtained with 5 g erepsin in 100 cc. of solution

	EULER's result			I $\begin{cases} K=0.0077156 \\ k'=0.93442 \end{cases}$			II $\begin{cases} K=0.101485\times10^{-4} \\ k'=1.04352 \end{cases}$		
t (mins.)	1000 $(a-x)$	1000 x	$\dfrac{10^3}{t}\log\dfrac{a}{a-x}$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
0	932	——	——	——	——	—	——	——	—
7	836	96	6.71	97	−1	1	96	0	0
15	744	188	6.54	186	+2	4	189	−1	1
22	675	257	6.37	254	+3	9	256	+1	1
30	612	320	6.10	323	−3	9	320	0	0
					+5−4=+1	23		+1−1=0	2
					P.E.=±2			P.E.=±1	

Table CV

Results of the application of T.N.N. I and II to data obtained
by Edlbacher and Simons with arginase

(i)   For data obtained with the solution of P_H value 7.38

t (hrs.)	x	I $\begin{cases} K=0.18927 \\ k'=0.41357 \end{cases}$			II $\begin{cases} K=0.0051821 \\ k'=0.61819 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
1	32.4	35.1	−2.7	7.29	33.5	−1	1.21
2	43.7	43.8	−0.1	0.01	44.4	−0.7	0.49
4	57.2	53.7	+3.5	12.25	55.0	+2.2	4.84
8	68.5	64.3	+4.2	17.64	65.2	+3.3	10.89
24	76.5	80.4	−3.9	15.21	78.7	−2.2	4.84
			+7.7−6.7=+1.0 P.E.=±2.4	52.40		+5.5−4.0=+1.5 P.E.=±1.6	22.27

(ii)   For data obtained with the solution of P_H value 8.9

t (hrs.)	x	I $\begin{cases} K=0.31330 \\ k'=0.25422 \end{cases}$			II $\begin{cases} K=0.010160 \\ k'=0.40272 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
1	46.9	50.6	−3.7	13.69	50.4	−3.5	12.25
2	57.6	56.9	+0.7	0.49	57.3	+0.3	0.09
4	67.8	63.3	+4.5	20.25	64.0	+3.8	14.44
8	72.2	69.8	+2.4	5.76	70.1	+2.1	4.41
24	76.0	79.4	−3.4	11.56	78.5	−2.5	6.25
			+7.6−7.1=+0.5 P.E.=±2.4	51.75		+6.2−6.0=+0.2 P.E.=±2.1	37.44

(iii)   For data obtained with the solution of P_H value 9.97

t (hrs.)	x	I $\begin{cases} K=0.18311 \\ k'=0.24019 \end{cases}$			II $\begin{cases} K=0.00518655 \\ k'=0.32240 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
1	33.1	34.4	−1.3	1.69	34.2	−1.1	1.21
2	40.5	39.2	+1.3	1.69	39.3	+1.2	1.44
4	45.4	44.5	+0.9	0.81	44.8	+0.6	0.36
8	50.0	50.0	0.0	0.00	49.8	+0.2	0.04
24	58.8	60.4	−1.6	2.56	59.1	−0.3	0.09
			+2.2−2.9=−0.7 P.E.=±0.9	6.75		+2.0−1.4=+0.6 P.E.=±0.6	3.14

TABLE CVI

Result of the application of T.N.N. I to data obtained
by BARENDRECHT with urease

t (mins.)	x (%)	I $\{K=0.0017742$ $\,k'=1.25265$			II $\{K=0.0023162$ $\,k'=1.18691$		
		Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
20	18.0	16.0	+2.0	4.00	17.0	+1.1	1.00
40	34.0	34.0	0.0	0.00	34.7	−0.7	0.49
60	47.5	49.8	−2.3	5.29	49.7	−2.2	4.84
80	57.5	62.8	−5.3	28.09	——	——	——
100	70.0	73.0	−3.0	9.00	71.7	−1.7	2.89
120	79.0	80.7	−1.7	2.89	79.1	−0 1	0.01
150	89.0	88.6	+0.4	0.16	87.0	+2.0	4.00
180	95.0	93.5	+1.5	2.25	——	——	——
210	97.5	96.4	+1.1	1.21	——	——	13.23
			+5.0−12.3=−7.3 P.E.=±1.7	52.89		+3.0−4.7=−1.7 P.E.=±1.1	

TABLE CVII

Results of the application of T.N.N. I and II to data
obtained by WESTER with urease

a=28.3		I $\{K=0.0033414$ $\,k'=0.93427$			II $\{K=0.60851 \times 10^{-4}$ $\,k'=1.33476$		
t (mins.)	x	Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
60	8.7	8.4	+0.3	0.09	8.2	+0.5	0.25
120	13.1	13.8	−0.1	0.49	14.4	−1.3	1.69
240	20.9	20.2	+0.7	0.49	18.6	+2.3	5.29
			+1.0−0.7=+0.3 P.E.=+0.5	1.07		+2.8=1.3=+1.5 P.E.=+1.3	7.23

a=56.6		I $\{K=0.32285 \times 10^{-2}$ $\,k'=0.75444$			II $\{K=0.87604 \times 10^{-4}$ $\,k'=0.87146$		
t (mins.)	x	Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
60	8.7	8.5	+0.2	0.04	8.5	0.0	0.00
120	13.1	13.6	−0.5	0.25	13.8	−0.7	0.49
240	21.4	21.0	+0.4	0.16	21.0	+0.4	0.16
			+0.6−0.5=+0.1 P.E.=±0.2	0.45		+0.4−0.7=−0.3 P.E.=±0.4	0.65

TABLE CVIII

Results of the application of T.N.N. I and II to data obtained by GEDDES and HUNTER with asparaginase

(i) For data obtained with 1.5 cc. of enzyme solution

t (hrs.)	x (%)	I $\{K=0.018862,\ k'=1.10635\}$ Calc. value	Diff. Δ	Δ²	II $\{K=0.35616\times10^{-3},\ k'=1.37311\}$ Calc. value	Diff. Δ	Δ²
2	9.5	8 9	+0.6	0.36	8.4	+1.1	1.21
4	17.6	18.2	−0.6	0.36	19.3	−1.7	2.89
6	26.8	27.0	−0.2	0.04	29.4	−2.6	6.76
8	34.2	35.2	−1 0	1.00	38.2	−4.0	16.00
12	47.3	49.3	−2.0	4.00	51.9	−4.6	21.16
16	59.1	60.7	−1.6	2.56	61.6	−2.5	6.25
20	73.4	69.7	+3.7	13.69	68 5	+4.9	24.01
24	77.4	76.8	+0.6	0.36	73.7	+3.7	13.69
			+4 9−5.4=−0.5 P.E.=±1.2	22.37		+9.7−15.4=−5.7 P.E.=±2.4	91.97

t (hrs.)	x (%)	$(t: 2\sim16)$ I $\{K=0.02044,\ k'=1.05777\}$ Calc. value	Diff. Δ	Δ²
2	9.5	9.2	+0.3	0.09
4	17.6	18.3	−0.7	0.49
6	26.8	26.7	+0.1	0.01
8	34.2	34.3	−0.1	0.01
12	47.3	47.6	−0.3	0.09
16	59.1	58.3	+0.8	0.64
			+1.2−1.1=+0.1 P.E.=±0.4	1.33

(ii) For data obtained with 2.5 cc. of enzyme solution

t (hrs.)	x (%)	I $\{K=0.031881,\ k'=1.23255\}$ Calc. value	Diff. Δ	Δ²	$(t: 1\sim16)$ I $\{K=0.033900,\ k'=1.17049\}$ Calc. value	Diff. Δ	Δ²
1	8.7	7.1	+1.6	2.56	7.5	+1.2	1.44
2	16.4	15.6	+0.8	0.64	16.1	+0.3	0.09
3	22.8	24.7	−1.9	3.61	24.6	−1.8	3.24
4	30.0	33.3	−3.3	10.89	32.7	−2.7	7.29
6	43.0	48.7	−5.7	32.49	47.1	−4.1	16.81
8	55.2	61.4	−6.2	38.44	59.0	−3.8	14.44
12	79.9	79.2	+0.7	0.49	76.1	+3.8	14.44
16	90.1	89.3	+0.8	0.64	86.6	+3.5	12.25
20	97.8	94.8	+3.0	9.00	—	—	—
			+6.2−17.8=−11.6 P.E.=±2.3	69.65		+8.8−12.4=−3.6 P.E.=−2.2	70.00

$(t: 1\sim12)$ I $\{K=0.035438,\ k'=1.12436\}$ Calc. value	Diff. Δ	Δ²	$(t: 1\sim1)$ I $\{K=0.037953,\ k'=1.03977\}$ Calc. value	Diff. Δ	Δ²
7.8	+0.9	0.81	8.4	+0.3	0.09
16.3	+0.1	0.01	16.4	0.0	0.00
24.5	−1.7	2.89	24.0	−1.2	1.44
32.6	−2.6	6.76	30.9	−0.9	0.81
45.8	−2.8	7.84	43.1	−0.1	0.01
57.1	−1.9	3.61	53.2	+2.0	4.00
73.7	+6.2	38.44	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—
	+7.2−9.0=−1.8 P.E.=±2.1	60.36		+2.3−2.2=+0.1 P.E.=±0.8	6.35

TABLE CIX

Results of the application of T.N.N. I and II taking 92.4 as the value of a to data obtained by EULER and KULLBERG with phosphatase, $K_1 = \dfrac{1}{t} \log \dfrac{a}{a-x}$

t (mins)	mg of $Mg_2P_2O_7$	K_1	x	I $\begin{cases} K=0.9804\times 10^{-3} \\ k'=1.00263 \end{cases}$			II $\begin{cases} k=0.101335\times 10^{-5} \\ k'=1.66308 \end{cases}$		
				Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
0	92.4	——	——	20.7	−2.5	6.25	17.6	+0.6	0.36
1?1	74.2	86	18.2	44.2	+3.3	10.89	49.0	−1.5	2.25
284	44.9	113	47.5	59.6	+5.9	34.81	65.4	+0.1	0.01
451	26.9	118	65.5	89.0	−1.7	2.89	87.2	+0.1	0.01
1440	5.1	——	87.3						
					+9.2−4.2 = +5.0 P.E.=±2.9	54.84		+0.8−1.5 = −0.7 P.E.=±0.6	2.63

TABLE CX

Results of the application of T.N.N. I and II to data obtained by DJENAB and NEUBERG with phosphatase,

$$K_1 = \frac{1}{t} \log \frac{a}{a-x}$$

DJENAB's result				I $\begin{cases} K=0.2304 \\ k'=0.39093 \end{cases}$			II $\begin{cases} K=0.0069347 \\ k'=0.56156 \end{cases}$		
t (days)	P_2O_2	x (%)	$K_1 \cdot 10^3$	Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
1	0.0258	38.9	328	41.2	−2.3	5.29	40.9	−2.0	4.00
2	0.0344	51.9	284	50.1	+1.8	3.24	50.5	+1.4	1.96
3	0.0385	58.1	233	55.7	+2.4	5.76	56.2	+1.9	3.61
5	0.0428	64.6	194	63.0	+1.6	2.56	63.1	+1.5	2.25
8	0.0442	66.7	——	69.8	−3.1	9.61	69.0	−2.3	5.29
					+5.8−5.4 = +0.4 P.E.±1.7	26.46		+4.8−4.3 = +0.5 P.E.=±1.4	17.11

TABLE CXI

Results of the application of T.N.N. I and II to data
obtained by NEMEC with phoshatase

t (hrs.)	NEMEC's result x	$K=\dfrac{x}{\sqrt{t}}$	$x\,(\%)$	$I\begin{cases}K=0.015698\\k'=0.42528\end{cases}$ Calc. value	Diff. Δ	Δ^2	$II\begin{cases}K=0.33229\times10^{-3}\\k'=0.47393\end{cases}$ Calc. value	Diff. Δ	Δ^2
16	98.94	24.7	9.89	11.09	−1.20	1.4400	11.00	−1.11	1.2321
24	140.65	28.7	14.07	13.03	+1.04	1.0816	13.03	+1.04	1.0816
48	169.36	24.5	16.94	15.63	+1.31	1.7161	17.23	−0.29	0.0841
72	215.00	25.3	21.50	19.97	+1.53	2.3409	20.14	+1.36	1.8496
96	224.85	22.9	22.49	32.27	+0.22	0.0484	22.42	+0.07	0.0049
168	282.80	(21.7)	28.28	27.35	+0.93	0.8649	27.37	+0.91	0.8281
336	325.60	(17.9)	32.56	34.90	−2.34	5.4756	34.36	−1.80	3.2400
				+5.03−3.54 =+1.49 P.E.=±1.0		12.9675	+3.38−3.20 =+0.18 P.E.=±0.8		8.3204

TABLE CXII

Results of the application of T.N.N. I and II to data
obtained by EULER and BRUNIUS with mutase

(i)   For data obtained in the absence of co-enzyme

t (mins.)	mg alde-hyde	$x\,(\%)$	$I\begin{cases}K=0.001076\\k'=0.95121\end{cases}$ Calc. value	Diff. Δ	Δ^2	$II\begin{cases}K=0.2299\times10^{-4}\\k'=0.98379\end{cases}$ Calc. value	Diff. Δ	Δ^2
0	52	——	——	——	——	——	——	——
15	50.3	3.3	3.2	+0.1	0.01	3.2	+0.1	0.01
30	49.0	5.8	6.1	−0.3	0.09	6.1	−0.3	0.09
45	47.5	8.7	8.8	−0.1	0.01	8.9	−0.2	0.04
60	45.8	11.9	11.5	+0.4	0.16	11.4	+0.5	0.25
			+0.5−0.4=+0.1 P.E.=±0.2		0.27	+0.6−0.5=+0.1 P.E.=±0.2		0.39

(ii) For data obtained in the presence of co-enzyme

t (mins.)	mg aldehyde	x (%)	I $\begin{cases} K=0.004113 \\ k'=1.05681 \end{cases}$			II $\begin{cases} K=0.57329\times 10^{-5} \\ k'=1.26576 \end{cases}$		
			Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ
0	51.4	——	——	——	——	——	——	——
15	43.5	15.4	15.2	+0.2	0.04	15.0	+0.4	0.16
30	36.6	28.8	29.2	−0.4	0.16	29.8	−1.0	1.00
45	30.4	40.8	41.1	−0.3	0.09	41.5	−0.7	0.49
60	24.8	51.7	51.2	+0.5	0.25	50.5	+1.2	1.44
				+0.7−0.7=—0 P.E.=±0.3	0.54		+1.6−1.7=−0.1 P.E.=±0.7	3.09

(iii) For data obtained in the presence of co-enzyme after treating the enzyme solution with acetic acid

t (mins.)	x (%)	I $\begin{cases} K=0.0012980 \\ k'=1.11693 \end{cases}$			II $\begin{cases} K=0.19792\times 10^{-4} \\ k'=1.27150 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
5	6.2	6.0	+0.2	0.04	5.8	+0.4	0.16
30	11.6	12.5	−0.9	0.81	13.0	−1.4	1.96
45	15.3	——					
60	26.0	25.1	+0.9	0.81	26.5	−0.5	0.25
			+1.1−0.9=+0.2 P.E.=±0.9	1.66		+0.4−1.9=−1.5 P.E.=±1.0	2.37

TABLE CXIII

Results of the application of T.N.N. I and II to data
obtained by WILLSTÄTTER and STOLL in the
decomposition of pyrogallol

t (mins.)	mg	x (%)	$K_1\cdot 10^4$	I $\begin{cases} K=0.011558 \\ k'=1.06219 \end{cases}$			II $\begin{cases} K=0.12141\times 10^{-3} \\ k'=1.47600 \end{cases}$		
				Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
5	19.6	14	130	14	0	0	12	2	4
10	39.2	28	143	26	+2	4	27	1	1
20	60.6	43	123	47	−4	16	51	−8	64
30	79.6	57	122	63	−6	36	65	−8	64
45	109.6	79	148	78	+1	1	77	+2	4
60	123.1	88	153	87	+1	1	84	+4	16
					+4−10=−6 P.E.=±3	58		9−16=−7 P.E.=±4	153

TABLE CXIV

Results of the application of T.N.N. I and II to data
obtained by BANSI in the decomposition of
guaiacol with horse radish extract

(i)   For data obtained with enzyme solution of 40 times dilution

			I $\begin{cases} K=0.038627 \\ k'=0.82728 \end{cases}$		II $\begin{cases} K=0.088016 \\ k'=0.96290 \end{cases}$	
t	x	$K=\dfrac{1}{t}\dfrac{x}{a(a-x)}$	Calc. value	Diff. Δ	Calc. value	Diff. Δ
1 min. 15 secs.	0.1	0.0833	0.10	0	0.10	0
2 mins. 5 ″	0.15	0.0833	0.15	0	0.15	0
3 ″ 0 ″	0.2	0.0833	0.20	0	0.20	0
5 ″ 15 ″	c.3	0.0817	0.30	0	0.30	0
8 ″ 0 ″	0.4	0.0833	0.40	0	0.40	0
12 ″ 30 ″	0.5	0.0800	0.50	0	0.50	0
$a=1$		mean 0.0825	0 P.E.$=\pm 0$		0 P.E.$=\pm 0$	

(ii)   For data obtained with enzyme solution of 20 times dilution

			I $\begin{cases} K=0.038630 \\ k'=0.83173 \end{cases}$		II $\begin{cases} K=0.171842 \\ k'=0.99869 \end{cases}$	
t (mins.)	x (%)	$\dfrac{1}{t}\dfrac{x}{a(a-x)}=K$	Calc. value	Diff. Δ	Calc. value	Diff. Δ
0.667	0.1	0.167	0.1	0	0.1	0
1.417	0.2	0.176	0.2	0	0.2	0
2.417	0.3	0.177	0.3	0	0.3	0
4.000	0.4	0.167	0.4	0	0.4	0
5.667	0.5	0.176	0.5	0	0.5	0
9.000	0.6	0.167	0.6	0	0.6	0
$a=1$		mean 0.171	0 P.E.$=\pm 0$		0 P.E.$=\pm 0$	

(iii)   For data obtained with enzyme solution of 10 times dilution

			I $\begin{cases} K=0.12045 \\ k'=0.82797 \end{cases}$		II $\begin{cases} K=0.34436 \\ k'=0.97951 \end{cases}$	
t	x	$\dfrac{1}{t}\dfrac{x}{a(a-x)}=K$	Calc. value	Diff. Δ	Calc. value	Diff. Δ
20 secs. (0.333 min.)	0.1	0.333	0.1	0	0.1	0
45 ″ (0.75 ″)	0.2	0.333	0.2	0	0.2	0
1 min. 20 ″ (1.333 mins.)	0.3	0.321	0.3	0	0.3	0
2 mins.	0.4	0.333	0.4	0	0.4	0
2 ″ 50 ″ (2.8333 ″)	0.5	0.353	0.5	0	0.5	0
4 ″ 10 ″ (4.1666 ″)	0.6	0.360	0.6	0	0.6	0
6 ″ 40 ″ (6.6667 ″)	0.7	0.356	0.7	0	0.7	0
$a=1$		mean 0.342	0 P. E.$=\pm 0$		0 P.E.$=\pm 0$	

TABLE CXV

Results of the application of T.N.N. II to data obtained by
EULER with catalase of shaggy boletus

(i) For data obtained with 4 cc. of enzyme solution

	EULER'S result		II $\begin{cases} K=0.21101 \times 10^{-3} \\ k'=1.28268 \end{cases}$			
t (mins.)	Titration number (cc.)	$K=\dfrac{1}{t}\log\dfrac{a}{a-x}$	x (%)	Calc. value	Diff. Δ	Δ^2
0	8.0	——	100.00	——	——	——
8	6.2	0.0138	22.5	33.3	−0.8	0.64
10	5.6	0.0154	30.0	28.8	+1.2	1.44
13	5.1	0.0150	36.3	36.2	+0.1	0.01
19	4.2	0.0147	47.5	48.0	−0.5	0.25
		mean 0.0147			+1.3=1.3=0 P.E.=±0.6	2.34

(ii) For data obtained with 5 cc. of enzyme solution

	EULER'S result		II $\begin{cases} K=0.40609 \times 10^{-3} \\ k'=1.16012 \end{cases}$			
t (mins.)	Titration number (cc.)	$K=\dfrac{1}{t}\log\dfrac{a}{a-x}$	x (%)	Calc. value	Diff. Δ	Δ^2
0	8.2	——	——	——	——	——
2	7.5	0.0193	8.5	8.3	+0.2	0.04
7	6.0	0.0193	26.8	28.0	−1.2	1.44
16	4.0	0.0195	51.2	50.3	+0.9	0.81
22	4.1	0.0190			+1.1−1.2=0.1 P.E.=±0.7	2.29
		mean 0.0193				

TABLE CXVI

Data obtained by RONA and DAMBOVICEANU with liver
catalase in the presence of NaCl

t (mins.)	O_2 (%)	$K=\dfrac{1}{t}\ln\dfrac{a}{a-x}$	$K=\dfrac{1}{t}\dfrac{\sqrt{a}-\sqrt{a-x}}{\sqrt{a-(a-x)}}$	$K=\dfrac{1}{t}\dfrac{x}{a(a-x)}$
5	16.48	0.03999	——	——
10	31.26	0.03742	0.00206	0.00045
15	42.24	0.03723	0.00210	0.00048
25	52.89	0.03082	0.00182	0.00045
30	55.30	0.02580	0.00162	0.00041

Table CXVII

Result of the application of T.N.N. II to data obtained by
Rona and Damboviceanu with liver catalase in
the precence of NaCl and Na_2HCO_3

t (mins.)	$O_2(\%)$	$K=\frac{1}{t}\ln\frac{a}{a-x}$	$K=\frac{1}{t}\frac{\sqrt{a}-\sqrt{x-a}}{\sqrt{a-(a-x)}}$	$K=\frac{1}{t}\frac{x}{a(a-x)}$	Calc. value	Diff. Δ	Δ^2
5	30.23	0.06287	0.00395	0.00086	30.14	+0.09	0.0081
10	46.71	——	0.00365	0.00087	47.27	−0.56	0.3136
15	58.39	——	0.00369	0.00093	57.89	+0.50	0.2500
25	40.41	——	0.00366	0.00093	40.19	+0.22	0.0484
30	73.80	0.04459	0.00315	0.00094	74.06	−0.26	0.0676
			mean 0.00362			+0.81−0.82 =−0.01 P.E. $=\pm0.25$	0.6877

Table CXVIII

Results of the application of T.N.N. I and II to data obtained
by Senter with blood catalase

(i) For data obtained with N/100,000 solution of HCl

t (mins.)	H_2O_2	$0.4343\cdot K_1$	$x(\%)$	I $\begin{cases}K=0.014072\\k'=1.00359\end{cases}$ Calc. value	Diff. Δ	Δ^2	II $\begin{cases}K=0.14200\times10^{-3}\\k'=1.45347\end{cases}$ Calc. value	Diff. Δ	Δ^2
0	22.7	——							
8	17.3	0.0147	23.8	23.8	0.0	0.00	22.7	+1.1	1.21
23	10.3	0.0150	54.6	54.4	+0.2	0.04	57.6	−3.0	9.00
38	6.2	0.0150	72.7	72.8	−0.1	0.01	73.8	−1.1	1.21
53	3.7	0.0150	83.7	83.7	0.0	0.00	82.1	+1.6	2.56
					+0.2−0.1=0.1 P.E. $=\pm0.1$	0.05		+2.7−4.1=−1.4 P.E. $=\pm1.5$	13.98

(ii) For data obtained with N/100,000 solution of HNO_3

t (mins.)	H_2O_2	$0.4343\cdot K_1$	$x(\%)$	I $\begin{cases}K=0.014218\\k'=1.06634\end{cases}$ Calc. value	Diff. Δ	Δ^2	II $\begin{cases}K=0.59840\times10^{-5}\\k'=1.51145\end{cases}$ Calc. value	Diff. Δ	Δ^2
0	22.7	——							
41	19.1	0.0018	15.9	15.8	+0.1	0.01	14.1	+1.8	3.24
71	16.7	0.0019	26.4	26.5	−0.1	0.01	27.5	−1.1	1.21
131	12.6	0.0020	44.5	44.7	−0.2	0.04	48.7	−4.2	17.64
250	7.0	0.0021	69.2	69.3	−0.1	0.01	71.6	−2.4	5.76
405	3.1	0.0022	86.3	86.1	+0.2	0.04	83.9	+2.4	5.76
					+0.3−0.4=−0.1 P.E. $=\pm0.1$	0.11		+4.2−7.7=−3.5 P.E. $=\pm2.0$	33.61

(iii) For data obtained with N/100,000 solution of H_2SO_4

t (mins.)	H_2O_2	$0.4343\cdot K_1$	I $\begin{cases}K=0.014518\\k'=1.00931\end{cases}$ $x(\%)$	Calc. value	Diff. Δ	Δ^2
0	22.7	——				
9	16.7	0.0148	26.4	26.4	0.0	0.00
24	9.9	0.0151	56.4	56.2	+0.2	0.04
39	5.9	0.0150	74.0	74.0	0.0	0.00
54	3.5	0.0150	84.6	84.6	0.0	0.00
					+0.2 P.E.$=\pm0.1$	0.04

TABLE CXIX

Results of the application of T.N.N. I to data obtained
by YAMAZAKI with blood catalase

(i) $C_0 = 0.02318$, $E_0 = 8$ cc., $25°C$

YAMAZAKI's result			$I\begin{cases} K = 0.14985 \\ k' = 0.82907 \end{cases}$		
t (mins.)	x	k'	Calc. value	Diff. Δ	$\Delta^2 \times 10^{10}$
2.4	0.01183	6.03	0.01182	$+0.00001$	1
6.3	0.01840	5.56	0.01844	-0.00004	16
10.6	0.02119	5.66	0.02117	$+0.00002$	4
15.7	0.02239	5.54	0.02239	0.00000	0
		5.70		$+0.00003-0.00004$ $=0.00001$ P.E. $=\pm0.00002$ $(\pm0.09\%)$	21

(ii) $C_0 = 0.02318$, $E_0 = 4$ cc., $25°C$

YAMAZAKI's re ult			$I\begin{cases} K = 0.097008 \\ k' = 0.67874 \end{cases}$		
t (mins.)	x	k'	Calc. value	Diff. Δ	$\Delta^2 \times 10^{10}$
4.1	0.01014	5.96	0.01023	-0.00009	81
8.7	0.01434	5.78	0.01439	-0.00005	25
16.5	0.01830	5.66	0.01799	$+0.00031$	961
25.8	0.02015	5.44	0.02013	$+0.00002$	4
39.0	0.02149	1.28	0.02160	-0.00011	121
		5.82		$+0.00033-0.00025$ $=0.00008$ P.E. $=\pm0.00010$ $(\pm0.43\%)$	1192

(iii) $C_0 = 0.02318$, $E_0 = 2$ cc., $25°C$

YAMAZAKI's result			$I\begin{cases} K = 0.078468 \\ k' = 0.43145 \end{cases}$			$(t: 3.9 \sim 33.4)$ $I\begin{cases} K = 0.065867 \\ k' = 0.51065 \end{cases}$		
t (mins.)	x	k'	Calc. value	Diff. Δ	$\Delta^2 \times 10^{10}$	Calc. value	Diff. Δ	$\Delta^2 \times 10^{10}$
3.9	0.00583	6.49	0.00655	-0.00072	5184	0.00607	-0.00014	196
8.7	0.00877	5.88	0.00854	$+0.00023$	529	0.00851	$+0.00026$	676
14.6	0.01081	5.68	0.01013	$+0$ cc068	4624	0.01041	$+0.00040$	1600
21.6	0.01216	5.55	0.01147	$+0.00069$	4661	0.01199	$+0.00007$	49
33.4	0.01332	5.38	0.01298	$+0.00034$	1156	0.01385	-0.00053	2809
63.8	0.01418	—	0.01535	-0.00117	13689	——	——	—
	•	5.66		$+0.00194-0.00189$ $=+0.00005$ P.E. $=\pm0.00052$ $(\pm2.2\%)$	29943		$+0.00073-0.00067$ $=+0.00007$ P.E. $=\pm0.00025$ $(\pm1.1\%)$	5330

(iv) $C_0 = 0.02108$, $E_0 = 2$ cc., $0°C$

Yamazaki's result			$I\begin{cases}K=0.061486\\k'=0.85508\end{cases}$		
t (mins.)	x	k'	Calc. value	Diff. Δ	$\Delta^2 \times 10^{10}$
3.3	0.00673	1.79	0.00685	-0.00012	144
6.7	0.01101	1.59	0.01082	$+0.00019$	361
11.3	0.01421	1.53	0.01424	-0.00003	9
15.9	0.01672	1.61	0.01641	$+0.00031$	961
21.7	0.01784	1.44	0.01813	-0.00026	676
		1.59	.	$+0.00050-0.00041$ $=-0.00009$ P.E.$=\pm0.00016$ $(\pm0.76\%)$	2151

(v) $C_0 = 0.04216$, $E_0 = 2$ cc., $0°C$

Yamazaki's result			$I\begin{cases}K=0.057356\\k'=0.69177\end{cases}$		
t (mins.)	x	k'	Calc. value	Diff. Δ	$\Delta^2 \times 10^{10}$
3.2	0.01049	1.98	0.01078	-0.00029	841
8.6	0.01965	1.87	0.01868	$+0.00097$	9409
14.7	0.02416	1.62	0.02410	$+0.00006$	36
22.9	0.02839	1.53	0.02884	-0.00045	2025
33.5	0.03231	1.54	0.03278	-0.00047	2209
44.5	0.03524	1.27	0.03529	-0.00004	16
59.9	0.03794	1.81	0.03767	$+0.00027$	729
		1.65		$+0.00130-0.00125$ $=+0.00005$ P.E.$=\pm0.00034$ $(\pm0.81\%)$	15265

(vi) $C_0 = 0.04639$, $E_0 = 4$ cc., $25°C$

Yamazaki's result			$I\begin{cases}K=0.149386\\k'=0.45466\end{cases}$		
t (mins.)	x	k'	Calc. value	Diff. Δ	$\Delta^2 \times 10^{10}$
3.6	0.02074	6.14	0.02133	-0.00059	3481
8.9	0.02861	5.41	0.02812	$+0.00049$	2401
14.7	0.03266	5.34	0.03195	$+0.00071$	5041
20.5	0.03477	5.29	0.03446	$+0.00031$	961
26.7	0.03628	5.43	0.03636	-0.00008	64
34.6	0.03740	5.57	0.03811	-0.00071	5041
				$+0.00151-0.00138$ $=+0.00013$ P.E.$=\pm0.00039$ $(\pm0.84\%)$	16989

(vii) $C_0 = 0.01159$, $E_0 = 2$ cc., $25°C$

YAMAZAKI's result			$I\begin{cases} K=0.086284 \\ k'=0.81227 \end{cases}$			
t (mins.)	x	k'	Calc. value	Diff. Δ	$\Delta^2 \times 10^{10}$
3.5	0.00485	5.99	0.00486	-0.00001	1
7.3	0.00740	5.79	0.00732	$+0.00008$	64
13.5	0.00939	5.51	0.00935	$+0.00004$	16
22.0	0.01055	5.22	0.01059	-0.00004	16
		5.63		$+0.00012-0.00005$ $= +0.00007$ P.E.$= \pm 0.00004$ $(\pm 0.35\%)$	97

TABLE CXX

Results of the application of T.N.N. I to data obtained by
MAZIMOWITSCH and AWTONOMOVA with catalase,

$$C_1 = \frac{1}{t}\log\frac{A}{A-x}, \quad C_M = \frac{1}{t(A-D)}\log\frac{D(A-x)}{A(D-x)}$$

(i) $A = 14.6$ cc. of $1/5$ n $KMnO_4$; 0.0075 cc. of blood

t (mins.)	x	C_1	C_M	D	Calc. value	Diff. Δ	Δ^2
				MAZIMOWITSCH's result		$I\begin{cases}K=0.042368\\k'=0.41416\end{cases}$	
10	3.05	0.0600	0.0025	$D_{t_{10}} - t_{20} = 5.865$	3.23	-0.18	0.0324
15	3.9	0.0422	0.0025	$D_{t_{10}} - t_{30} = 5.875$	3.78	$+0.12$	0.0144
20	4.35	0.0326	0.0026	$D_{t_{10}} - t_{40} = 5.865$	4.18	$+0.17$	0.0289
30	5.0	0.0227	0.0025	$D_{t_{10}} - t_{60} = 5.855$	4.80	$+0.20$	0.0400
40	5.35	0.0178	0.0025	$D_{t_{15}} - t_{30} = 5.825$	5.29	$+0.06$	0.0036
60	5.70	0.0102	0.0025	$D_{t_{20}} - t_{40} = 5.775$	6.02	-0.32	0.1024
				$D_{t_{20}} - t_{40} = 5.825$ $D_{t_{20}} - t_{60} = 5.975$		$+5.5-0.50=-0.05$ P.E.$= \pm 0.14$	0.2217
				mean 5.875			

(ii) $A = 58.4$ cc. of $1/5$ n $KMnO_4$; 0.0075 cc. of blood

t (mins.)	x	C_1	C_M	D	Calc. value	Diff. Δ	Δ^2
				MAZIMOWITSCH's result		$I\begin{cases}K=0.016329\\k'=0.25045\end{cases}$	
10	3.6	0.00276	0.00095	$D_{t_{10}} - t_{20} = 5.125$	3.76	-0.16	0.0256
15	4.25	0.00219	0.00093	$D_{t_{10}} - t_{30} = 5.075$	4.15	$+0.10$	0.0100
20	4.65	0.00180	0.00096	$D_{t_{15}} - t_{30} = 5.125$	4.44	$+0.21$	0.0441
30	4.95	0.00128	0.00093	$D_{t_{15}} - t_{40} = 5.08$	4.90	$+0.05$	0.0025
40	5.05	0.00098	0.00092	$D_{t_{20}} - t_{30} = 5.075$	5.26	-0.21	0.0441
				mean 5.1		$+0.36-0.37=-0.01$ P.E.$= \pm 0.12$	0.1263

(iii) $A = 7.4$ cc. of $1/5$ n $KMnO_4$; 0.015 cc. of blood

t (mins.)	x	C_1	C_M	D	Calc. value	Diff. Δ	Δ^2
				MAZIMOWITSCH's result		I $\begin{cases} K=0.042391 \\ k'=0.81664 \end{cases}$	
10	3.4	0.027	0.0023	$D_{t_{10}} - t_{40} = 15.1$	3.5	−0.1	0.01
15	4.4	0.026	0.0024	$D_{t_{10}} - t_{60} = 13.75$	4.4	0.0	0.00
20	5.075	0.026	//	$D_{t_{15}} - t_{30} = 13.785$	5.0	+0.075	0.005625
30	5.9	0.023	//	$D_{t_{15}} - t_{40} = 13.6$	5.9	0.0	0.00
40	6.4	0.022	//	$D_{t_{20}} - t_{80} = 13.0$	6.4	0.0	0.00
60	6.9	0.022	0.0023	$D_{t_{20}} - t_{60} = 12.25$	6.9	0.0	0.00
				mean 13.7		+0.075−0.1=−0.025	0.15625
						P.E.=±0.0	

(iv) $A = 14.8$ cc. of $1/5$ n $KMnO_4$; 0.15 cc. of blood

t (mins.)	x	C_1	C_M	D	Calc. value	Diff. Δ	Δ^2
				MAZIMOWITSCH's result		I $\begin{cases} K=0.055949 \\ k'=0.58544 \end{cases}$	
10	5.45	0.0199	0.0018	$D_{t_{10}} - t_{20} = 14.5$	5.79	−0.34	0.1156
15	6.9	0.0182	//	$D_{t_{10}} - t_{40} = 13.8$	6.91	−0.01	0.0001
20	7.95	0.0167	//	$D_{t_{10}} - t_{60} = 14.3$	7.77	+0.18	0.0324
30	9.3	0.0163	//	$D_{t_{15}} - t_{30} = 13.85$	9.04	+0.26	0.0676
40	10.15	0.0126	//	$D_{t_{15}} - t_{60} = 14.4$	9.95	+0.20	0.0400
60	11.4	0.0107	0.0019		11.21	+0.19	0.0361
120	12.725	0.0071	//	mean 14.17	13.03	−0.305	0.093025
						+0.83−0.655=+0.174	0.384825
						P.E.=±0.19	

(v) $A = 19.5$ cc. of $1/5$ n $KMnO_4$; 0.0015 cc. of blood

t (mins.)	x	C_1	C_M	D	Calc. value	Diff. Δ	Δ_2
				MAZIMOWITSCH's result		I $\begin{cases} K=0.046898 \\ k'=0.35254 \end{cases}$	
10	4.0	0.0099	0.0023	$D_{t_{10}} - t_{20} = 6.5$	4.2	−0.2	0.04
15	4.95	0.0085	0.0025	$D_{t_{10}} - t_{30} = 6.7$	4.77	+0.18	0.0324
20	5.4	0.0070	0.0024	$D_{t_{15}} - t_{30} = 6.45$	5.2	+0.2	0.04
30	6.0	0.0053	0.0024		5.9	+0.1	0.01
40	6.1	0.0041		mean 6.55	6.4	−0.3	0.09
						+0.48−0.5=−0.02	0.2124
						P.E.=±0.16	

(vi) $A = 19.5$ cc. of $1/5$ n $KMnO_4$; 0.003 cc. of blood

Mazimowisch's result					$1\begin{cases}K=0.111126\\k'=0.35633\end{cases}$		
t (mins.)	x	C_1	C_M	D	Calc. value	Diff. Δ	Δ^2
10	8.05	0.0231	0.0030	$D_{t_{10}}-t_{40}=13.1$	8.60	-0.55	0.3025
15	9.7	0.0199	0.0032	$D_{t_{10}}-t_{60}=12.4$	9.54	$+0.16$	0.0256
20	10.7	0.0173	0.0033	$D_{t_{20}}-t_{40}=12.75$	10.02	$+0.68$	0.4624
30	11.6	0.0131	0.0032	$D_{t_{15}}-t_{40}=12.85$	11.25	$+0.35$	0.1225
40	12.16	0.0106	0.0034	$D_{t_{20}}-t_{40}=12.85$	11.98	$+0.18$	0.0324
60	12.45	0.0074	0.0030	mean 12.79	13.01	-0.56	0.3136
						$+1.37-1.11$ $=-0.26$ P.E.$=\pm0.34$	1.2590

(vii) $A = 19.5$ cc. of $1/5$ n $KMnO_4$; 0.0045 cc. of blood

Mazimowisch's result					$1\begin{cases}K=0.11330\\k'=0.55465\end{cases}$		
t (mins.)	x	C_1	C_M	D	Calc. value	Diff. Δ	Δ^2
10	11.5	0.0387	0.0030	$D_{t_{10}}-t_{40}=21$	11.85	-0.35	0.1225
15	13.55	0.0344	0.0031	$D_{t_{10}}-t_{10}=20.5$	13.46	$+0.09$	0.0081
20	14.8	0.0309	0.0032	$D_{t_{15}}-t_{40}=20.25$	14.57	$+0.23$	0.0529
30	16.25	0.0259	0.0032	$D_{t_{20}}-t_{40}=20.25$	16.01	$+0.24$	0.0576
40	16.95	0.0221	0.0031	$D_{t_{30}}-t_{60}=19.65$	16.91	$+0.04$	0.0016
60	17.75	0.0078	0.0030	mean 20.33	17.94	-0.19	0.0361
						$+0.60-0.54$ $=+0.06$ P.E.$=\pm0.16$	0.2788

Table CXXI

Result of the application of T.N.N. I to data obtained
by Aberson with zymase

Aberson's result				I $\begin{cases} K=0.530725 \times 10^{-3} \\ k'=1.10745 \end{cases}$		
t (mins.)	Spec. rot. power	$K \cdot 10^5$	Exp. value	Calc. value	Diff. Δ	Δ^2
0	36.4	—	—	—	—	—
34	34.2	154	2.2	2.1	+0.1	0.01
68	31.9	158	4.5	4.5	0.0	0.00
86	30.7	157	5.7	5.7	0.0	0.00
136	27.7	156	8.7	8.9	—0.2	0.04
182	24.7	156	11.7	11.7	0.0	0.00
246	21.6	152	14.8	15.3	—0.5	0.25
304	18.8	151	17.6	18.1	—0.5	0.25
404	14.0	152	22.4	22.2	+0.2	0.04
572	8.4	154	28.0	27.3	+0.7	0.49
					+1.0—1.2 = —0.2 P.E. = ±0.2	1.08

Table CXXII

Result of the application of T.N.N. I to data obtained by
Euler in the decomposition of glucose by zymase

(i)　20 cc. of enzyme solution + 2 g glucose in 20 cc.; 30°C

Euler's result				I $\begin{cases} K=0.123026 \times 10^{-3} \\ k'=0.99815 \end{cases}$		
t (mins.)	x	$a-x$	$K \cdot 10^4$	Calc. value	Diff. Δ	Δ^2
0	0	520				
200	27	493	1.16	28	—1	1
301	43	477	1.25	42	+1	1
465	66	454	1.26	62	+4	16
561	77	443	1.24	76	+1	1
923	113	407	1.15	118	—5	25
			mean 1.20		+6—6=0 P.E.=±2 (0.4%)	44

(ii) 10 cc. of enzyme solution + 10 cc. of H_2O + 8 g glucose in 20 cc.; 30°C.

Euler's result				x (%)	I $\begin{cases} K=0.34655 \times 10^{-3} \\ k'=1.01988 \end{cases}$		
t (mins.)	x	$a-x$	$K \cdot 10^5$		Calc. value	Diff. Δ	Δ^2
0	0	2145	—				
117	21	2142	3.6	9.8	9.8	0	0
251	47	2098	3.4	21.4	22.2	−0.8	0.64
361	62	2080	3.5	28.9	27.8	+1.1	1.21
460	73	2072	3.3	34.0	33.9	+0.1	0.01
564	85	2060	3.1	39.6	40.0	−0.4	0.16
			mean 3.4			+1.2−1.2=0 P.E.=±0.5	2.02

(iii) 10 cc. of enzyme solution + 8 g glucose in 20 cc.; 37.6°C

t (mins.)	x	$a-x$	$K \cdot 10^5$	x (%)
0	0.000	3.908	—	
194	0.062	3.834	3.6	1.6
361	0.110	3.798	3.5	2.8
411	0.120	3.788	3.4	3.2
458	0.143	3.765	3.5	3.7
509	0.153	3.755	3.4	3.9
			mean 3.5	

(iv) 20 cc. of enzyme solution + 4 g glucose in 30 cc.; 30°C

Euler's result				x (%)	I $\begin{cases} K=0.24072 \times 10^{-3} \\ k'=0.95907 \end{cases}$		
t (mins.)	x	$a-x$	$K \cdot 10^5$		Calc. value	Diff. Δ	Δ^2
0	0	1070	—				
84	40	1030	1.97	3.7	3.8	−0.1	0.01
125	63	1007	2.11	5.9	5.5	+0.4	0.16
218	92	978	1.80	8.6	9.2	−0.6	0.36
328	140	930	1.86	13.1	13.4	−0.3	0.09
355	158	912	1.95	14.8	14.3	+0.5	0.25
385	171	899	1.96	15.0	15.4	+0.6	0.36
410	175	895	1.89	16.4	16.3	+0.1	0.01
669	259	811	1.80	24.2	24.7	−0.5	0.25
			mean 1.92			+1.6−1.5=+0.1 P.E.=±0.3	1.49

Table CXXIII

Results of the application of T.N.N. I and $\dfrac{1}{t^{k'}}\log\dfrac{a+x}{a-x}=K$

to data obtained by Herzog in the decomposition
of glucose by thymin

(i)　1.136 n glucose solution + 1.2 g thymin, 2.4°C

	Herzog's result			I $\begin{cases}K=0.71753\times10^{-4}\\k'=1.08600\end{cases}$			$\dfrac{1}{t^{k'}}\log\dfrac{a+x}{a-x}=K$ $\begin{cases}K=0.0002191\\k'=1.00155\end{cases}$		
t (mins.)	$a-x$	$0.4343K_1$	x	Calc. value	Diff. Δ	$\Delta^2\times10^6$	Calc. value	Diff. Δ	$\Delta^2\times10^6$
120	0.961	0.000144	0.045	0.044	+0.001	1	0.046	−0.001	1
240	0.922	0.000147	0.089	0.092	−0.003	9	0.091	−0.002	4
1200	0.673	0.000146	0.214	0.213	+0.001	1	0.205	+0.009	81
1440	0.549	0.000149	0.557	0.539	+0.018	324	0.527	+0.030	900
2690	0.396	0.000149	0.926	0.941	−0.015	225	0.968	−0.044	1936
				+0.020−0.018 =+0.002 P.E. =+0.008 (±0.9%)		560	+0.039−0.047 =−0.008 P.E. =±0.018 (±1.8%)		2922

(ii)　1.704 n glucose solution + 1.8 g thymin, 24.5°C

	Herzog's result			I $\begin{cases}K=0.1256\times10^{-3}\\k'=1.02967\end{cases}$			$\dfrac{1}{t^{k'}}\log\dfrac{a+x}{a-x}=K$ $\begin{cases}K=0.37447\times10^{-3}\\k'=0.94668\end{cases}$		
	$a=1.5$								
t (mins.)	$a-x$	K_A	$x(\%)$	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
120	1.455	0.000108	3.9	3.9	0.0	0.00	4.0	−0.1	0.01
240	1.411	0.000107	7.8	7.8	0.0	0.00	7.9	−0.1	0.01
540	1.286	0.000115	32.7	34.8	−2.1	4.41	33.3	−0.6	0.36
1440	0.943	0.000117	45.1	40.4	+4.7	22.09	39.8	+5.3	28.09
3000	0.574	0.000104	60.4	62.6	−2.2	4.84	64.2	−3.8	14.44
				+4.7−4.3 =+0.4 P.E. =±1.9		31.34	+5.3−4.6 =+0.7 P.E. =±2.2		42.91

TABLE CXXIV

Applicable T.N.N. equations for various enzymes and substrates in decomposition taking time as a variable

Enzyme	Substrate	Data obtained by	Equation
Lipase and esterase			
Castor bean	Soy bean oil	NAKAJIMA	I
,,	Cotton seed oil	NICLOUX	I
,,	Olive oil	WILLSTÄTTER and WALDSCHMIDT-LEITZ	I
,,	Castor bean oil	,,	I
,,	Triacetin	TAYLOR	I
Papain	Soy bean oil	NAKAJIMA	II
,,	Olive oil	SANDBERG and BRAND	II
Fly amanita	,,	ZELLNER	II
Stomach	Egg-yolk	STADE	I
Pancreas	,,	ENGEL	?
,,	Triacetin	WILLSTÄTTER and MEMMEN	?
,,	Ester (synthesis)	DIETZ	I ?
,,	,, (decomposition)	,,	I
Liver	Ethyl acetate	HERZOG	?
,,	Ethyl butyrate	KASTLE ETC.	II ?
Fatty tissue	,,	EULER	I
Blood	Tributyrin	RONA and EBSEN	I
,,	Monobutyrin	PIGHINI	I
Chlorophyllase	Chlorophyll	WILLSTÄTTER and STOLL	II
Lichenase	Lichenin	KARRER, JOOS and STAUB; PRINGSHEIM and SEIFERT	II
Inulase	Inulin	BOSELLI	I
Cellobiase	Cellobiose	PRINGSHEIM and LEIBOWITZ	II ?
Amylase			
Taka-diastase	Starch	PHILOCHE	I
Malt	,,	HENRI	I
,,	,,	BROWN and GLENDINNING	?
Pancreas	,,	HENRI	I
Liver	Starch, glycogen	HOLMBERGH	II
Maltase			
Löwenbräu yeast	Maltose	WILLSTÄTTER ETC.	I
Taka-diastase	,,	PHILOCHE	?
Ottakring yeast	α-Methyl glucoside	WILLSTÄTTER ETC.	II
Löwenbräu yeast	α-Ethyl glucoside	WILLSTÄTTER and OPPENHEIMER	I
,,	α-Phenyl glucoside	,,	II
Emulsin	Salicin	HERZOG	I
,,	Arbutin	WILLSTÄTTER and OPPENHEIMER	I
,,	β-Metyl glucoside	,,	I
,,	β-Phenyl glucoside	,,	I
,,	Helicin	,,	I

Enzyme	Substrate	Data obtained by	Equation
Emulsin	Raffinose	Willstätter and Csanyi	I
Invertase	Sucrose	Michelis and Menten	I
,,	,,	Nelson and Hitchcock	I
,,	,,	Euler and Kullberg	I
Raffinase	Raffinose	Willstätter and Kuhn; Colin and Chaudan	I
Lactase	Lactose	Willstätter and Oppenheimer, Armstrong	I
Mannase	Mannan	Miyake	I
Tannase	Tannin	Freudenberg	I ?
Pepsin	Proteins of barley	Nakamura	II
,,	Glycinin	Nakajima	II
,,	Egg-white	Matsuyama and Nakamura	II
,,	Serum albumin	Rona and Kleinmann	II
Trypsin	Glycinin	Nakajima	I
,,	Casein	Rona and Kleinmann	I
Papain	Glycinin	Nakajima	II
Protease			
Koji-kin	Peptone	Oshima	II
,,	Casein	,,	I
Barley	Glutin	Weiss	II
Yeast	(auto-digestion)	Dernby	I
Peptidase			
Yeast	Glycyl-l-leucin	Abderhalden and Fodor	?
Erepsin	Glycyl-glycin	Euler	?
Arginase	Arginine	Gross; Edlbacher and Simons	II
Urease	Urea	Barendrecht; Wester	I
Asparaginase	Asparagine	Geddes and Hunter	I
Phosphatase	Na-phosphate	Euler and Kullberg	II
,,	Na-saccharophosphate	Djenab and Neuberg	II
,,	Glycerophosphate	Nemec	II
Mutase	Aldehyde	Euler and Brunius	I
Peroxidase			
Lettuce	Pyrogallol	Willstätter and Stoll	I
Horse radish	Guaiacol	Bansi	?
Catalase			
Yeast	Hydrogen peroxide	Issajew	I
Shaggy boletus	,,	Euler	II
Liver	,,	Rona and Damboviceanu	II ?
Blood	,,	Senter	I
,,	,,	Yamazaki	I
,,	,,	Maximowitsch and Avtonomova	I
Soy bean	,,	Yamazaki	I
Zymase	Glucose	Aberson	I
,,	,,	Euler	I
,,	,,	Herzog	I

TABLE CXXV

Result of the application of T.N.N. (E) I to data obtained
by NICLOUX in the decomposition of olive
oil with castor bean lipase

NICLOUX's result			For $\dfrac{x}{e} = K$		(E) I $\begin{cases} K=0.35091 \\ k'=0.99816 \end{cases}$		
After 30 mins.		$\dfrac{x}{e} = K$					
Enzyme g	%	$\dfrac{x}{e}$	Calc. value	Diff. Δ	Calc. value	Diff. Δ	Δ²
0.048	3.8	79	3.5	+ 0.3	3.8	0.0	0.00
0.096	7.3	76	7.0	+ 0.3	7.5	−0.2	0.04
0.192	14.9	78	13.8	+ 1.1	14.4	+0.5	0.25
0.382	27.4	71	27.7	− 0.3	26.7	+0.7	0.49
0.768	45.2	59	55.8	−10.6	46.3	−1.1	1.21
		mean 72.6		+1.7−10.9=−9.2 mean ±2.5		+1.2−1.3=−0.1 P.E.=±0.5	1.99

TABLE CXXVI

Result of the application of T.N.N. (E) I to data obtained
by JALANDER in the decomposition of cotton seed
oil with castor bean lipase

JALANDER's result			For $\dfrac{x}{E} = K$		$\dfrac{x}{E} = K$ (E : 0.001∼0.015)	
E	%	$\dfrac{x}{E \times 10^3}$	Calc. value	Diff. Δ	Calc. value	Diff. Δ
0.001	4.46	4.46	4.15	+ 0.31	4.31	+ 0.15
0.002	9.04	4.52	8.30	+ 0.74	8.62	+ 0.42
0.003	13.85	4.65	12.45	+ 1.40	12.93	+ 0.92
0.004	17.82	4.45	16.60	+ 1.22	17.24	+ 0.58
0.005	22.10	4.40	20.75	+ 1.35	21.55	+ 0.55
0.010	41.57	4.16	41.50	+ 0.07	43.10	− 0.53
0.015	53.08	3.56	62.25	− 9.17	64.65	−11.57
0.020	58.99	2.99	83.00	−24.01	—	—
		mean 4.15		+5.09−33.18=−28.09 mean 4.78		+2.62−13.10=−10.48 mean 2.12

(E) I $\begin{cases} K=0.020695 \\ k'=1.01398 \end{cases}$			(E : 1∼15) (E) I $\begin{cases} K=0.020045 \\ k'=1.04788 \end{cases}$		
Calc. value	Diff. Δ	Δ²×10⁴	Calc. value	Diff. Δ	Δ²×10⁴
4.64	−0.18	324	4.51	−0.05	25
9.17	−0.13	169	9.10	−0.06	36
13.51	+0.34	1156	13.58	+0.27	729
17.66	+0.16	256	17.90	−0.08	64
21.63	+0.47	2209	22.06	+0.04	16
38.87	+2.70	72900	40.27	+1.30	16900
52.77	+0.31	961	54.64	−1.56	24336
62.99	−4.00	160000	—	—	—
	+3.98−4.31=−0.33 P.E.=±1.2	237975		+1.61−1.75=−0.14 P.E.=±0.6	42106

TABLE CXXVII

Results af the application of T.N.N. (E) I and II to data
obtained by ARMSTRONG in the decomposition
of milk sugar by lactase

Lactase cc.	x (%)	$\dfrac{x}{E}=K$	$\dfrac{x}{E}=K$ Calc. value	Diff. Δ	(E) I $\begin{cases}K=0.014632\\k'=0.98306\end{cases}$ Calc. value	Diff. Δ	Δ²	(E) II $\begin{cases}K=0.353435\times10^6\\k'=1.01956\end{cases}$ Calc. value	Diff. Δ	Δ²
0.66	2.3	3.48	2.0	+0.1	2.2	+0.1	0.01	2.2	+0.1	0.01
1.0	3.2	3.20	3.2	0.0	3.3	—0.1	0.01	3.3	—0.1	0.01
2.0	6.3	3.15	6.5	—0.2	6.4	—0.1	0.01	6.5	—0.2	0.04
5.0	15.4	3.08	16.2	—0.8	15.1	+0.3	0.09	15.1	+0.3	0.09
		mean 3.23		+0.1—1.0 =—0.9 mean 0.3		+0.4—0.2 =—0.2 P.E.=±0.1	0.12		+0.4—0.3 =+0.1 P.E.=±0.2	0.15

TABLE CXXVIII

Data obtained by E. SCHÜTZ in the decomposition of
egg-white by pepsin

E	(Exp. value)	(Caltd. by $\dfrac{x}{\sqrt{E}}=K$)	Diff. Δ
1	9.4	10.8	—1.40
4	20.61	21.6	—0.99
9	32.33	32.4	—0.07
16	45.35	43.2	+2.15
25	55.21	54.1	+1.11
36	64.96	64.9	+0.06
49	75.97	75.7	+0.27
64	85.25	86.5	—1.35
	389.08	389.10	+3.59—3.81=—0.22

TABLE CXXIX

Some calculated results of examining the applicability of

the SCHÜTZ equation $\dfrac{x}{\sqrt{E}}=K$

E	x	$\dfrac{x}{\sqrt{E}}=K$	$E:\ 1\sim64$		$E:\ 1\sim49$		$E:\ 4\sim46$	
			Calc. value for $K=10.65$	Diff. Δ	Calc. value for $K=10.65$	Diff. Δ	Calc. value for $K=10.83$	Diff. Δ
1	9.4	9.40	10.65	−1.25	10.65	−1.25	——	——
4	20.61	10.31	21.30	−0.69	21.30	−0.69	21.66	−0.28
9	32.33	10.78	31.95	+0.38	31.95	+0.38	32.49	−0.16
16	45.35	11.34	42.60	+2.75	42.60	+2.75	43.32	+2.03
25	55.21	10.04	53.25	+1.96	53.25	+1.96	54.15	+1.06
36	64.96	10.83	63.90	+1.06	63.90	+1.06	64.98	−0.02
49	75.97	10.85	74.55	+0.42	74.55	+0.42	76.01	−0.04
64	85.25	10.66	85.20	+0.05	——	——	86.64	−1.39
		mean 10.65		+6.62−1.94 =−4.68 mean ±1.07		+6.57−1.94 =+4.63 mean ±1.22		−3.09−1.89 =+1.20 mean ±0.71

TABLE CXXX

Data obtained by E. SCHÜTZ in the decomposition
of egg-white by pepsin

(I)			(II)		
E	x (Exp. value)	x (Calc. value)	E	x (Exp. value)	x (Calc. value)
1	7.3	7.4	1	53.96	52.10
2	9.75	10.4	2	77.43	73.67
3	12.8	12.7	3	86.53	90.22
4	14.8	14.7	4	103.27	104.20
5	16.5	16.4			
6	18.45	18.9			

Table CXXXI

Result of the application of T.N.N. (E) I to data obtained by
J. Schütz in comparison with that of Arrhenius's equation

$a=0.158$		$\dfrac{x}{\sqrt{E}}=K$	
E	x	Calc. value	Diff. Δ
1	0.0212	0.0213	—0.0001
4	0.0471	0.0426	+0.0045
9	0.0652	0.0639	+0.0013
16	0.0799	0.0852	—0.0053
25	0.0935	0.1065	—0.0130
36	0.1031	0.1278	—0.0247
			+0.0058—0.0431=—0.0373
			mean ±0.0082 (±5.2%)

Arrhenius's equation		(E) I $\begin{cases} K=0.065925 \\ k'=0.55477 \end{cases}$		
Calc. value	Diff. Δ	Calc. value	Diff. Δ	$\Delta^2 \times 10^8$
0.0231	—0.0019	0.0223	—0.0011	121
0.0444	+0.0027	0.0441	+0.0030	900
0.0651	+0.0001	0.0634	+0.0018	324
0.0793	+0.0006	0.0800	—0.0001	1
0.0935	——	0.0941	—0.0006	36
0.1059	—0.0028	0.1058	—0.0027	729
	+0.0034—0.0047		+0.0048—0.0045	2111
	=—0.0013		=+0.0003	
	mean ±0.0014		P.E.=±0.0014	

Table CXXXII

Results of the application of T.N.N. (E) I and II to data
obtained by Sandberg and Brand in the decompo-
sition of olive oil by papain

Papain (mg)	x	$\dfrac{x}{e}$	$\dfrac{x}{\sqrt{e}}=K$	(E) I $\begin{cases} K=0.91419\times10^{-3} \\ k'=0.817582 \end{cases}$			(E) II $\begin{cases} K=0.156863\times10^{-4} \\ k'=0.83823 \end{cases}$		
				Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
10	1.0	0.100	0.32	1.0	0.0	0.00	1.1	—0.1	0.01
20	2.0	0.100	0.45	1.9	+0.1	0.01	1.9	+0.1	0.01
40	3.2	0.080	0.51	3.3	—0.1	0.01	3.3	—0.1	0.01
80	6.1	0.076	0.68	5.7	+0.4	0.16	5.8	+0.3	0.09
100	7.1	0.071	0.71	6.9	+0.2	0.04	6.9	+0.2	0.04
160	10.3	0.064	0.81	9.9	+0.4	0.16	9.9	+0.4	0.16
320	15.4	0.048	0.86	16.8	—1.4	1.96	16.5	—1.1	1.21
					+1.1—1.5	2.35		+1.0—1.3	1.53
					=—0.4			=—0.3	
					P.E.=±0.4			P.E.=±0.4	

TABLE CXXXIII

Results of the application of T.N.N. I and II to data obtained
by WILLSTATTER, WALDSCHMIDT-LEITZ and MEMMEN in the
decomposition of olive oil by pancreas lipase

E	x (%)	$(E: 1.33 \sim 13.33)$ (E) I $\begin{cases} K=0.02759 \\ k'=0.60792 \end{cases}$			(4th datum omitted) (E) I $\begin{cases} K=0.027821 \\ k'=0.59263 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
1.33	7.4	7.3	$+0.1$	0.01	7.3	$+0.1$	0.01
3.99	13.1	13.1	-0.6	0.36	13.5	-0.4	0.16
7.98	20.1	20.1	0.0	0.00	19.7	$+0.4$	0.16
10.00	24.0	22.7	$+1.3$	1.69	——	——	——
13.33	25.7	26.4	-0.7	0.49	25.7	0.0	0.00
			$+1.4-1.3$ $=+0.1$ P.E.$=\pm0.6$	2.55		$+0.5-0.4$ $=+0.1$ P.E.$=\pm0.3$	0.33

$(E: 1.33 \sim 13.33)$ (E) II $\begin{cases} K=0.64547 \times 10^{-3} \\ k'=0.65849 \end{cases}$			(4th datum omitted) (E) II $\begin{cases} K=0.65159 \times 10^{-3} \\ k'=0.64128 \end{cases}$		
Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
7.2	$+0.2$	0.04	7.3	$+0.1$	0.01
13.8	-0.7	0.49	13.7	-0.6	0.36
20.2	-0.1	0.01	19.8	$+0.3$	0.09
22.7	$+1.3$	1.69	——	——	——
26.2	-0.5	0.25	25.5	$+0.2$	0.04
	$+1.5-1.3=+0.2$ P.E.$=\pm0.6$	2.48		$+0.6-0.6=0$ P.E.$=\pm0.3$	0.50

TABLE CXXXIV

Results of the application of T.N.N. (E) I and II to data obtained by KASTLE and LOEVENHART in the decomposition of ethyl butyrate by liver lipase

E	x (%)	(E) I $\begin{cases} K=0.0048228 \\ k'=0.64623 \end{cases}$			(E) II $\begin{cases} K=0.10867 \times 10^{-3} \\ k'=0.66757 \end{cases}$		
		Calc. value	Diff. Δ	$\Delta^2 \times 10^4$	Calc. value	Diff. Δ	$\Delta^2 \times 10^4$
5	3.00	3.09	−0.09	81	2.14	+0.86	7396
10	5.05	4.80	+0.25	625	4.81	+0.24	576
20	7.32	7.41	−0.09	81	7.97	−0.65	4225
40	11.25	11.35	−1.10	100	11.32	−0.07	49
			+0.25−0.28 =−0.03 P.E.=±0.14	887		+1.1−0.72 =+0.38 P.E.=±0.53	12246

TABLE CXXXV

Results of the application of T.N.N. (E) I and II to data obtained by SCHMIDT in saponification of morphine glycollic acid ester by liver extract

E	x	$K=\dfrac{1}{t\sqrt{E}}\ln\dfrac{a}{a-x}$			(E)I$\begin{cases} K=406056 \times 10^{-3} \\ k'=0.43042 \end{cases}$			(E) II$\begin{cases} K=0.0212225 \\ k'=0.64345 \end{cases}$		
		K	x (Calc. value)	Diff.	Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
0.10	34	0.57	31	+3	34	0	0	33	+1	1
0.25	48	0.57	44	+4	46	+2	4	47	+1	1
0.50	56	0.51	56	0	56	0	0	58	−2	4
0.75	59	0.45	64	−5	63	−4	16	64	−5	25
1.00	67	0.48	68	−1	67	0	0	68	−1	1
2.00	80	0.49	81	−1	78	+2	4	77	+3	9
		mean 0.51		+7−7=0 mean ±2		+4−4=0 P.E.=±2	24		+5−8=−3 P.E.=±2	41

TABLE CXXXVI

Results of the application of T.N.N. (E) I and II to data obtained
by STADE in the decomposition of egg-yolk by stomach lipase

For data obtained in decomposition for 1 hr.

(E) I $\{K=0.020225,\ k'=0.58774\}$ — (E) II $\{K=0.47348\times10^{-3},\ k'=0.62477\}$

Original data			Diff. Δ	(E) I Calc. value	(E) I Diff. Δ	Δ²	(E) II Calc. value	(E) II Diff. Δ	Δ²
F	x	$x=K\sqrt{Ft}$							
1	4.1	6.2	−2.1	4.6	−0.5	0.25	3.2	+0.9	0.81
4	11.2	12.1	−0.9	10.0	+1.2	1.44	10.1	+1.1	1.21
9	17.3	17.8	−0.5	15.6	+1.7	2.89	15.7	+1.6	2.56
16	21.3	23.2	−1.9	21.1	+0.2	0.04	21.1	+0.2	0.04
25	23.6	28.4	−4.8	25.4	−1.8	3.24	26.1	−2.5	6.25
			−10.2 mean −2.0		+3.1−2.3 = +0.8 P.E.=±1.1	7.86		+3.8−2.5 = +1.3 P.E.=±1.3	10.87

For data obtained in decomposition for 4 hrs.

(E) I $\{K=0.06994,\ k'=0.45399\}$ — (E) II $\{K=0.0017302,\ k'=0.53365\}$

Original data			Diff. Δ	(E) I Calc. value	(E) I Diff. Δ	Δ²	(E) II Calc. value	(E) II Diff. Δ	Δ²
F	x	$x=K\sqrt{Ft}$							
1	13.7	12.1	+1.6	14.8	−1.1	1.21	14.7	−1.0	1.00
4	28.0	23.2	+4.8	26.1	+1.9	3.61	26.6	+1.4	1.96
9	38.9	33.3	+5.6	35.4	+3.5	12.25	35.9	+3.0	9.00
16	44.0	42.5	+1.5	43.3	+0.7	0.49	43.2	+0.8	0.64
25	45.4	50.7	−5.3	50.1	−4.7	22.09	49.1	−3.7	13.69
			+13.5−5.3 = +8.2 mean ±3.7		+6.1−5.8 = +0.3 P.E.=±2.5	39.65		+5.2−4.7 = +0.5 P.E.=±2.0	26.29

For data obtained in decomposition for 16 hrs.

(E) I $\{K=0.108345,\ k'=0.50075\}$ — (E) II $\{K=0.0025215,\ k'=0.70577\}$

Original data			Diff. Δ	(E) I Calc. value	(E) I Diff. Δ	Δ²	(E) II Calc. value	(E) II Diff. Δ	Δ²
F	x	$x=K\sqrt{Ft}$							
1	21.6	23.2	− 1.6	22.1	−0.5	0.25	20.1	+1.5	2.25
4	40.7	42.5	− 1.8	39.3	+1.4	1.96	40.1	+0.6	0.36
9	50.9	58.0	− 7.1	52.8	−1.9	3.61	54.3	−3.4	11.56
16	67.4	70.3	− 2.9	63.2	+4.2	17.64	63.6	+3.8	14.44
25	68.4	79.6	−11.2	71.4	−3.0	9.00	71.0	−2.6	6.74
			−24.6 mean −4.9		+5.6−5.4 = −0.2 P.E.=±2.2	32.46		+5.9−6.0 = −0.1 P.E.=±2.3	35.35

For data obtained in decomposition for 24 hrs.

(E) I $\{K=0.019884,\ k'=0.55875\}$ — (E) II $\{K=0.463000\times10^{-3},\ k'=0.59524\}$

Original data			Diff. Δ	(E) I Calc. value	(E) I Diff. Δ	Δ²	(E) II Calc. value	(E) II Diff. Δ	Δ²
F	x	$x=K\sqrt{Ft}$							
1	4.7	4.7	0.0	4.5	+0.2	0.04	4.4	+0.3	0.09
4	8.5	9.5	−1.0	9.4	−0.9	0.81	9.6	−1.1	1.21
9	15.0	13.2	+1.8	14.5	+0.5	0.25	14.6	+0.4	0.16
16	19.5	19.0	+0.5	19.4	+0.1	0.01	19.4	+0.1	0.01
25	24.5	23.7	+0.8	24.2	+0.3	0.09	23.9	+0.6	0.36
			+3.1−1.0 = +2.1 mean ±0.8		+1.1−0.9 = +0.2 P.E.=±0.4	1.20		+1.4−1.1 = +0.3 P.E.=±0.5	1.83

TABLE CXXXVII

Results of the application of T.N.N. (E) I and II, taking 154 as the value of a, to data obtained by OSHIMA in the decomposition of soluble starch by amylase for 20 mins.

E (%)	x (mg)	(E) I $\{K=0.163335, k'=0.49519\}$ Calc. value	Diff. Δ	Δ²	(E:0.1~1.0) (E) I $\{K=0.195577, k'=0.61012\}$ Calc. value	Diff. Δ	Δ²	(E) II $\{K=0.00297515, k'=0.55524\}$ Calc. value	Diff. Δ	Δ²
0.1	13.6	17.4	−3.8	14.44	16.1	−2.5	6.25	17.4	−2.8	7.84
0.2	28.2	24.0	+4.2	17.64	23.9	+4.3	19.59	24.2	+4.0	16.00
0.5	45.5	36.1	+9.4	88.76	39.3	+6.2	38.44	36.7	+8.8	77.44
1.0	48.5	48.3	+0.2	0.04	55.8	−7.3	53.29	48.4	+0.1	0.01
2.0	54.6	63.4	−8.8	77.44	—	—	—	61.9	−7.3	53.29
			+13.8−12.6 =+1.2 P.E.=±5.1	197.92		−10.5+9.8 =+0.7 P.E.=±4.3	117.57		+12.9−10.1 =+2.8 P.E.=±4.8	154.58

TABLE CXXXVIII

Results of the application of T.N.N. (E) I and II, taking 120 as the value of a to data obtained by OSHIMA given in the previous table

E	x (mg)	(E) I $\{K=0.223915, k'=0.51606\}$ Calc. value	Diff. Δ	Δ²	(E) II $\{K=0.0050505, k'=0.60240\}$ Calc. value	Diff. Δ	Δ²
0.1	13.6	17.4	−3.8	14.44	17.4	−3.8	14.44
0.2	28.2	21.8	+6.4	40.96	24.2	+4.0	16.00
0.5	45.5	36.3	+9.2	84.64	37.0	+8.5	72.25
1.0	48.5	48.4	+0.1	0.01	48.5	0.0	0.00
2.0	54.6	62.6	−8.0	64.00	60.9	−6.3	39.69
			+15.7−11.8=+3.9 P.E.=±4.8	204.05		+12.5−10.1=+2.4 P.E.=±4.0	142.38

TABLE CXXXIX

Results of the application of T.N.N. (E) I and II to data obtained by OSHIMA in the decomposition of soluble starch by amylase for 1 hr.

E	x (mg)	$a=154$ (E) I $\{K=0.19931, k'=0.36109\}$ Calc. value	Diff. Δ	Δ²	$a=120$ (E) II $\{K=0.27726, k'=0.38064\}$ Calc. value	Diff. Δ	Δ²
0.04	17.3	20.6	−3.3	10.89	20.5	−3.2	10.24
0.1	29.4	27.9	+1.5	2.25	28.0	+1.4	1.96
0.2	41.1	34.8	+6.3	39.69	35.1	+6.0	36.00
0.5	50.2	46.2	+4.0	16.00	46.5	+3.7	13.69
1.0	55.3	56.7	−1.4	1.96	56.6	−1.3	1.69
2.0	62.2	68.5	−6.3	39.69	67.7	−5.5	30.25
			+11.8−11.0=+0.8 P.E.=±3.2	110.48		+11.1−10.0=+1.1 P.E.=±2.9	93.83

Table CXL

Results of the application of T.N.N. (E) I and II to data
obtained by Pringsheim and Baur in the
decomposition of purified lichenin

For data obtained in decomposition for 8 hrs.	E	x (%)	(E) I $\begin{cases} K=0.05032 \\ k'=0.56138 \end{cases}$			(E) II $\begin{cases} K=0.0011727 \\ k'=0.65364 \end{cases}$		
			Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
	2	15.1	15.7	−0.6	0.36	15.9	−0.8	0.64
	4	23.1	22.3	+0.8	0.64	22.5	+0.6	0.36
	8	32.4	31.1	+1.3	1.69	31.4	+1.0	1.00
	16	40.8	42.3	−1.5	2.25	41.8	−1.0	1.00
				+2.1−2.1=0 P.E.=±0.9	4.94		+1.6−1.8=−0.2 P.E.=±0.7	3.00

For data obtained in decomposition for 16 hrs.	E	x (%)	(E) I $\begin{cases} K=0.12450 \\ k'=0.54178 \end{cases}$			(E) II $\begin{cases} K=0.33336\times 10^{-2} \\ k'=0.65826 \end{cases}$		
			Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
	2	34.7	34.1	+0.6	0.36	34.2	+0.5	0.25
	4	45.2	45.5	−0.3	0.09	45.4	−0.2	0.04
	8	56.3	58.7	−2.4	5.76	56.7	−0.4	0.16
	16	67.7	72.4	−4.7	22.09	67.4	+0.3	0.09
				+0.6−7.4=−6.8 P.E.=±2.1	28.30		+0.8−0.6=+0.2 P.E.=±0.3	0.54

Table CXLI

Results of the application of T.N.N. (E) I and II to data
obtained by Pringsheim and Baur in the
decomposition of ordinary lichenin

For data obtained in decomposition for 48 hrs.	E	x (%)	(E) I $\begin{cases} K=0.20064 \\ k'=0.48815 \end{cases}$			(E) II $\begin{cases} K=0.005991 \\ k'=0.69468 \end{cases}$		
			Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
	0.5	28.5	24.5	+4.0	16.00	26.9	+1.6	2.56
	1.0	36.7	37.0	−0.3	0.09	37.3	−0.6	0.36
	2.5	50.1	51.8	−1.7	2.89	53.2	−2.1	4.41
	5.0	63.2	63.7	−0.5	0.25	64.6	−1.4	1.96
	10.0	76.6	75.9	+0.7	0.49	74.7	+1.9	3.61
				+4.7−2.5=+2.2 P.E.=±1.5	19.72		+3.5−4.1=−0.6 P.E.=±1.2	12.90

For data obtained in decomposition for 72 hrs.	E	x (%)	(E) I $\begin{cases} K=0.206943 \\ k'=0.56779 \end{cases}$			(E) II $\begin{cases} K=0.66127\times 10^{-2} \\ k'=0.95511 \end{cases}$		
			Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
	0.5	28.5	27.5	+1.0	1.00	25.4	+3.1	9.61
	1.0	36.7	37.9	−1.2	1.44	39.8	−3.1	9.61
	2.5	58.8	55.1	+3.7	13.69	61.3	−2.5	6.25
	5.0	75.0	69.5	+5.5	30.25	75.5	−0.5	0.25
	10.0	86.9	82.7	+4.2	17.64	85.6	+1.3	1.69
				+14.4−1.2=+13.2 P.E.=±2.9	64.02		+4.4−6.1=−1.7 P.E.=−2.0	27.41

TABLE CXLII

Results of the application of T.N.N. (E) I and II to data
obtained by FREUDENBERG and VOLLBRECHT in the
decomposition of tannin

For all data

E	(g)	x (%)	(E) I $\begin{cases}K=0.103826\\k'=0.82560\end{cases}$ (E: 0.01—0.10)			(E) II $\begin{cases}K=0.24668\times10^{-2}\\k'=1.14612\end{cases}$ (E: 0.01—0.10)		
			Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
0.01	1	20.5	21.3	−0.8	0.68	19.8	+0.7	0.49
0.014	1.4	27.3	27.1	+0.2	0.04	26.6	+0.7	0.49
0.02	2	34.9	34.5	+0.4	0.16	35.3	−0.4	0.16
0.03	3	46.2	44.7	+1.5	2.25	46.5	−0.3	0.09
0.04	4	53.4	52.8	+0.6	0.36	54.7	−1.3	1.69
0.05	5	59.5	59.5	0.0	0.00	60.9	−1.4	1.96
0.06	6	64.7	65.0	−0.3	0.09	65.8	−1.1	1.21
0.07	7	69.0	69.6	−0.6	0.36	69.6	−0.6	0.36
0.08	8	72.7	73.6	−0.9	0.81	72.8	−0.1	0.01
0.10	10	80.0	79.8	+0.2	0.04	77.5	+2.5	6.25
				+2.9−2.6 =+0.3 P.E.=±0.5	4.75		+3.9−5.2 =−1.3 P.E.=±0.9	12.71

For data omitting the 4th datum

E	(g)	x (%)	(E) I $\begin{cases}K=0.103017\\k'=0.82774\end{cases}$			(E) II $\begin{cases}K=0.0024719\\k'=0.14556\end{cases}$		
			Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
0.01	1	20.5	21.1	−0.6	0.36	19.8	+0.7	0.49
0.014	1.4	27.3	26.9	+0.4	0.16	26.7	+0.6	0.36
0.02	2	34.9	34.4	+0.5	0.25	35.4	−0.5	0.25
0.03	3	46.2	—	—	—	—	—	—
0.04	4	53.4	52.6	+0.8	0.64	54.7	−1.3	1.69
0.05	5	59.5	59.3	+0.2	0.04	61.0	−1.5	2.25
0.06	6	64.7	64.8	−0.1	0.01	65.8	−1.1	1.21
0.07	7	69.0	69.5	−0.5	0.25	69.7	−0.7	0.49
0.08	8	72.7	73.5	−0.8	0.64	72.8	−0.1	0.01
0.10	10	80.0	79.7	+0.3	0.09	77.6	+2.4	5.76
				+2.2−2.0 =+0.2 P.E.=±0.4	2.44		+3.7−5.2 =−1.5 P.E.=±0.8	12.51

TABLE CXLIII

Results of the application of T.N.N. (E) I to data obtained by MATSUYAMA and NAKAMURA in the decomposition of egg-white by pepsin

E	Quantity decomposed (g)	x (%)	(E) I $\begin{cases} K=0.56387 \\ k'=0.51950 \end{cases}$		
			Calc. value	Diff. Δ	$\Delta^2 \times 10^4$
0.0002	0.0188	9.40	9.61	−0.21	444
0.0004	0.0265	13.25	13.48	−0.23	529
0.0006	0.0328	16.40	16.37	+0.03	9
0.0008	0.0368	18.15	16.83	+1.32	17424
0.0010	0.0409	20.45	20.79	−0.34	1156
0.0012	0.0447	22.35	22.60	−0.25	625
0.0014	0.0493	24.65	24.09	+0.56	3136
0.0016	0.0515	25.75	25.74	+0.01	1
0.0018	0.0536	26.80	27.11	−0.31	961
0.0020	0.0560	28.00	28.43	−0.43	1849
			+1.92−1.77=+0.15 P.E.=±0.36		26131

E	Quantity decomposed (g)	x (%)	(E) I $\begin{cases} K=3.76825 \\ k'=0.47320 \end{cases}$		
			Calc. value	Diff. Δ	$\Delta^2 \times 10^4$
0.0002	0.0272	13.60	14.29	−0.69	4761
0.0004	0.0395	19.75	19.23	+0.50	2500
0.0006	0.0453	22.65	22.84	−0.19	361
0.0008	0.0503	25.15	23.39	+1.76	30976
0.0010	0.0566	28.30	28.12	+0.18	324
0.0012	0.0595	29.75	30.23	−0.48	2304
0.0014	0.0641	32.05	32.10	−0.05	25
0.0016	0.0673	33.65	33.80	−0.13	225
0.0018	0.0705	35.25	35.34	−0.09	81
0.0020	0.0720	36.00	36.77	−0.77	5929
			+2.44−2.42=+0.02 P.E.=±0.49		47486

E	Quantity decomposed (g)	x (%)	(E) I $\begin{cases} K=3.8261 \\ k'=0.45149 \end{cases}$			$\begin{pmatrix} \text{4th datum} \\ \text{omitted} \end{pmatrix}$ (E) I $\begin{cases} K=4.01955 \\ k'=0.46039 \end{cases}$		
			Calc. value	Diff. Δ	$\Delta^2 \times 10^4$	Calc. value	Diff. Δ	$\Delta^2 \times 10^4$
0.0002	0.0321	16.05	17.16	−1.11	12321	16.75	−0.70	49
0.0004	0.0471	23.55	22.75	+0.80	6400	22.30	+1.25	15625
0.0006	0.0519	25.95	26.60	−0.65	4225	26.23	−0.28	784
0.0008	0.0600	30.00	27.20	+2.80	78400	—	—	—
0.0010	0.0657	32.85	32.26	+0.59	3481	31.94	+0.91	8241
0.0012	0.0684	34.20	34.55	−0.35	1225	34.20	0.00	0
0.0014	0.0732	36.60	36.46	+0.14	196	36.19	+0.41	1681
0.0016	0.0752	37.60	38.22	−0.62	3844	37.67	−0.07	49
0.0018	0.0779	38.95	39.14	−0.19	361	39.61	−0.66	4356
0.0020	0.0812	40.60	41.30	−0.70	4900	41.11	−0.51	2601
			+4.33−2.62 =+0.71 P.E.=±0.79		115353	+2.57−2.22 =+0.35 P.E.=±0.49		38277

TABLE CXLIV

Results of the application of T.N.N. (E) I and II to data obtained
by OSHIMA in the decomposition of WITTE's
peptone with aspergillus protease

E	x (%)	(E) I $\begin{cases} K=0.25743 \\ k'=0.59357 \end{cases}$			(E) II $\begin{cases} K=0.0082436 \\ k'=0.72147 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
2.0	56.3	59.1	−2.8	7.84	57.6	+1.3	1.69
1.0	45.2	44.7	+0.5	0.25	45.2	0.0	0.00
0.5	35.4	32.5	+2.9	8.41	33.3	+2.1	4.41
0.25	24.0	22.9	+1.1	1.21	23.3	+0.7	0.49
0.125	14.5	15.8	−1.3	1.69	15.5	−1.0	1.00
			+4.5−4.1 =+0.4 P.E.=±1.5	19.40		+2.8−2.3 =+0.5 P.E.=±0.9	7.59

TABLE CXLV

Results of the application of T.N.N. (E) I and II to data
obtained by GROSSMANN and DYCKERHOFF in the
decomposition of d-l-leucyl-glycyl-glycin

E	x (%)	(E) I $\begin{cases} K=0.91755 \\ k'=1.13899 \end{cases}$			(E) II $\begin{cases} K=0.047034 \\ k'=1.43842 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
0.05	5	7	−2	4	6	−1	1
0.10	16	14	+2	4	15	+1	1
0.20	30	29	+1	1	32	−2	4
0.30	41	42	−1	1	45	−4	16
0.40	52	53	−1	1	56	−4	16
0.60	72	69	+3	9	69	+3	9
0.80	83	81	+2	4	77	+6	36
(1.20)	(100)		+8−4=+4 P.E.=±1	24		10−11=−1 P.E.=±3	83

TABLE CXLVI

Results of the application of T.N.N (E) I to data obtained
by GEDDES and HUNTER with asparaginase

	E	x (%)	(E) I $\begin{cases} K=0.08557 \\ k'=1.13407 \end{cases}$		
			Calc. value	Diff. Δ	Δ^2
For data obtained in decomposition for 6 hrs.	1.5	26.8	26.8	0	0
	2.0	35.0	35.1	−1	1
	2.5	43.0	42.7	+3	9
	3.0	49.4	49.6	−2	4
				+3−3=0 P.E.=±0.1	14
	E	x (%)	(E) I $\begin{cases} K=0.105188 \\ k'=1.32563 \end{cases}$		
			Calc. value	Diff. Δ	Δ^2
For data obtained in decomposition for 8 hrs.	1.5	34.2	33.9	+0.3	0.09
	2.0	45.2	45.5	−0.3	0.09
	2.5	55.2	55.8	−0.6	0.36
	3.0	65.2	64.4	+0.8	0.64
				+1.1−0.9=+0.2 P.E.=±0.4	1.18
	E	x (%)	(E) I $\begin{cases} K=0.12704 \\ k'=1.87830 \end{cases}$		
			Calc. value	Diff. Δ	Δ^2
For data obtained in decomposition for 12 hrs.	1.5	47.3	46.6	+0.7	0.49
	2.0	64.8	65.9	−1.1	1.21
	2.5	79.9	80.5	−0.6	0.36
	3.0	90.6	89.8	+0.8	0.64
				+1.5−1.7=−0.2 P.E.=±0.6	2.70

Table CXLVII

Results of the application of T.N.N. (E) I and II to data obtained by Tammann in the decomposition of salicin by emulsin for 24 hrs.

E	x (%)	(E) I $\begin{cases} K=0.027305 \\ k'=0.81441 \end{cases}$			$(E : 31.2\sim3.9)$ (E) I $\begin{cases} K=0.021008 \\ k'=0.3732 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
62.5	51.8	55.3	-3.5	12.25	—	—	—
31.2	46.4	42.6	$+3.8$	14.44	46.4	0.0	0.00
15.6	32.6	29.4	$+3.2$	10.24	31.0	$+1.6$	2.56
11.7	27.2	24.7	$+2.5$	6.25	25.3	$+1.9$	3.61
7.8	17.9	18.8	-0.9	0.81	18.6	-0.7	0.49
3.9	11.7	11.4	$+0.3$	0.09	10.5	$+1.2$	1.44
			$+9.8-4.4=+5.4$	44.08		$+4.7-0.7=+4.0$	8.10
			P.E.$=\pm2.0$			P.E.$=\pm1.0$	

E	x (%)	(E) II $\begin{cases} K=0.72282\times10^{-3} \\ k'=1.09098 \end{cases}$			(2nd datum omitted) (E) II $\begin{cases} K=0.76952\times10^{-3} \\ k'=1.04191 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
62.5	51.8	53.2	-1.4	1.96	52.2	-0.4	0.16
31.2	46.4	43.8	$+2.6$	6.76	—	—	—
15.6	32.6	31.8	$+0.8$	0.64	31.1	$+1.5$	2.25
11.7	27.2	26.7	$+0.5$	0.25	26.2	$+1.0$	1.00
7.8	17.9	20.1	-2.2	4.84	19.9	-2.0	4.00
3.9	11.7	11.4	$+0.3$	0.06	11.4	$+0.3$	0.09
			$+4.2-3.6=+0.6$	14.54		$+2.8-2.4=+0.4$	7.50
			P.E.$=\pm1.2$			P.E.$=\pm0.9$	

Table CXLVIII

Results of the application of T.N.N. (E) I to data
obtained by Tammann in the decomposition
of salicin for 12 hrs.

E	x (%)	$\begin{cases}K=0.148386\\k'=0.9c823\end{cases}$			(3rd datum omitted) $\begin{cases}K=0.14522\\k'=0.89995\end{cases}$			$(E:5\sim0.078)$ $\begin{cases}K=0.153525\\k'=0.94278\end{cases}$		
		Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
10.0	91.3	93.7	−2.4	5.76	93.0	−1.7	2.89	—	—	—
5.0	80.0	77.1	+2.9	8.41	75.9	+4.1	16.81	80.1	−0.1	0.01
2.5	59.3	54.4	+4.9	24.01	—	—	—	56.8	+2.5	6.25
1.25	34.7	34.2	+0.5	0.25	33.6	+1.1	1.21	35.4	−0.7	0.49
0.625	20.3	20.0	+0.3	0.09	19.7	+0.6	0.36	20.3	0.0	0.00
0.312	12.2	11.2	+1.0	1.00	11.1	+1.1	1.21	11.1	+1.1	1.21
0.156	5.8	6.1	−0.3	0.09	6.1	−0.3	0.09	6.0	−0.2	0.04
0.078	2.8	3.3	−0.5	0.25	3.3	−0.5	0.25	3.1	−0.3	0.09
			+9.6−3.2 =−6.4 P.E.=±1.6	39.86		+6.9−2.5 =+4.4 P.E.=±1.3	22.82		+3.6−1.3 =+2.3 P.E.=±0.8	8.09

Table CXLIX

Results of the application of T.N.N. (E) I and II to data
obtained by Auld using amygdalase

E	x	$(E:2\sim50)$ (E) I $\begin{cases}K=0.0149534\\k'=0.59861\end{cases}$			$(E:2\sim25)$ (E) I $\begin{cases}K=0.08931\\k'=0.72612\end{cases}$		
		Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
2	3.6	5.1	−1.5	2.25	4.6	−1.0	1.00
3	6.0	6.4	−0.4	0.16	6.2	−0.2	0.04
4	8.9	7.6	+1.3	1.69	7.5	+1.4	1.96
6	12.5	9.6	+2.9	8.41	10.0	+2.5	6.25
12	17.1	14.1	+3.0	9.00	16.0	+1.1	1.21
25	21.6	21.1	+0.5	0.25	25.7	−4.1	16.81
50	24.1	30.1	−6.0	36.00	—	—	—
			+7.7−7.9 =−0.2 P.E.=±2.1	57.76		+5.0−5.3 =−0.3 P.E.=±1.6	27.27

$(E:2\sim50)$ (E) II $\begin{cases}K=0.34164\times10^{-3}\\k'=0.638312\end{cases}$			$(E:2\sim25)$ (E) II $\begin{cases}K=0.45201\\k'=0.54285\end{cases}$		
Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
5.0	−1.4	1.96	6.2	−2.6	6.76
6.4	−0.4	0.16	7.6	−1.6	2.56
7.6	+1.3	1.69	8.8	+0.1	0.01
9.7	+2.8	7.84	10.7	+1.8	3.24
14.3	+2.8	7.84	14.8	+2.3	5.29
21.1	+0.5	0.25	20.6	+1.0	1.00
29.0	−4.9	24.01	—	—	—
	+7.4−6.7=+0.7 P.E.=±2.0	43.75		+5.2−4.2=1.0 P.E.=±1.9	18.86

TABLE CL

Applicable T.N.N. (E) equations for various enzymes and substrates in decomposition taking the relative quantity of enzyme as a variable

Enzyme	Substrate	Data obtained by	Equation
Lipase			
Castor bean	Soy bean oil	NAKAJIMA	I
,,	Olive oil	NICLOUX	I
,,	Cotton seed oil	JALANDER	I
Papain	Soy bean oil	NAKAJIMA	II
,,	Olive oil	SANDBERG and BRAND	II
Pancreas	Egg-yolk	ENGEL	?
,,	Olive oil	WILLSTÄTTER, WALDSCHMIDT-LEITZ and MEMMEN	?
Liver	Ethyl butyrate	KASTLE and LOEVENHART	I
,,	Morphine glycollic acid	SCHMIDT	I
Stomach	Egg-yolk	STADE	?
Amylase	Soluble starch	OSHIMA	Can not exist
Lichenase	Lichenin	PRINGSHEIM and SEIFFRT	II ?
Tannase	Tannin	FREUDENBERG and VOLLBRECHT	I
Lactase	Lactose	ARMSTRONG	?
Pepsin	Glycinin	NAKAJIMA	I
,,	Egg-white	MATSUYAMA and NAKAMURA	I
Pancreatin	Glycinin	NAKAJIMA	I
Protease	WITTE's peptone	OSHIMA	II
,,	Casein	,,	II
Polypeptidase	Leucyl-glycyl-glycin	GROSSMANN and DYCKERHOFF	I
Asparaginase	Asparagin	GEDDES and HUNTER	I
Emulsin	Salicin	TAMMANN	I ?
Amygdalase	Amygdalin	AULD	?

TABLE CLI

Results of the application of T.N.N. (S) I and II to data
obtained by JALANDER in the decomposition of
olive oil by castor bean lipase

S	$100-x$	(S) I $\begin{cases} K=0.0138328 \\ k'=0.80914 \end{cases}$			(S) II $\begin{cases} K=0.258953 \times 10^{-3} \\ k'=0.95018 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
50	51	53	-2	4	52	-1	1
25	40	35	$+5$	25	36	$+4$	16
20	29	31	-2	4	31	-2	4
15	23	23	0	0	25	-2	4
10	19	19	0	0	19	0	0
5	11	11	0	0	11	0	0
			$+5-4=+1$ P.E.$=\pm 2$	33		$+4-5=-1$ P.E.$=\pm 2$	25

S	$100-x$	(S) I $\begin{cases} K=0.014493 \\ k'=0.77930 \end{cases}$			(S) II $\begin{cases} K=0.272727 \times 10^{-3} \\ k'=0.91697 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
50	51	50.6	$+0.4$	0.16	49.6	$+1.4$	1.96
20	29	29.1	-0.1	0.01	29.8	-0.8	0.64
15	23	24.1	-1.1	1.21	24.6	-1.6	2.56
10	19	18.2	$+0.8$	0.64	18.4	$+0.6$	0.36
5	11	11.8	-0.8	0.64	10.7	$+0.3$	0.09
			$+1.2-2.0$ $=-0.8$ P.E.$=\pm 0.6$	2.66		$+2.3-2.4$ $=-0.1$ P.E.$=\pm 0.8$	5.61

TABLE CLII

Result of the application of T.N.N. (S) I to data obtained
by TAMMANN in the decomposition of amygdalin

Amygdalin, g in 20 cc.		(S) I $\begin{cases} K=0.80620 \\ k'=0.20062 \end{cases}$		
S	$100-x$	Calc. value	Diff. Δ	Δ^2
0.51	80	80	0	0
1.02	85	85	0	0
2.04	88	88	0	0
			0	0

TABLE CLIII

Result of the application of T.N.N. (S) I to data obtained
by BROWN in the decomposition of sucrose

Cane sugar, g in 100 cc.		(S) I $\begin{cases} K=0.290173 \\ k'=0.46254 \end{cases}$		
S	$100-x$	Calc. value	Diff. Δ	Δ^2
4.89	74.8	75.1	-0.3	0.09
9.85	86.2	85.4	$+0.8$	0.64
19.91	93.2	93.0	$+0.2$	0.04
29.96	95.9	96.0	-0.1	0.01
40.02	97.3	97.5	-0.2	0.04
			$+1.0-0.6=+0.4$ P.E.$=\pm 0.3$	0.82

Table CLIV

Results of the application of T.N.N. (S) I to data obtained
by Barth in the decomposition of sucrose

Cane sugar in 100 cc. g	$100-x$	(S) I $\begin{cases} K=0.37177 \\ k\prime=0.42626 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2
0.5	60.0	—	—	—
1.0	57.0	57.5	−0.5	0.25
2.5	74.0	71.8	+2.2	4.84
5.0	80.0	81.7	−1.7	2.89
7.5	86.6	86.7	0.0	0.00
10.0	89.6	89.8	−0.2	0.04
15.0	93.1	93.4	−0.3	0.09
20.0	95.8	95.4	+0.4	0.16
			$+2.6-2.7=-0.1$ P.E.$=\pm0.8$	8.27

Table CLV

Results of the application of T.N.N. (S) I and II to
data obtained by Herzog, Becker and
Kasarnowski using maltase

	S	Exp. value $(100-x)$	(S) I $\begin{cases} K=0.31542 \\ k\prime=0.36839 \end{cases}$			(S) II $\begin{cases} K=0.0073875 \\ k\prime=0.76488 \end{cases}$		
			Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
1	4.67	72.2	72.3	−0.1	0.01	71.6	+0.6	0.36
	9.33	80.5	80.9	−0.4	0.16	81.3	−0.8	0.64
	13.99	86.2	85.3	+0.9	0.81	85.7	+0.5	0.25
	18.66	87.7	88.2	−0.5	0.25	88.3	−0.6	0.36
	27.99	91.6	91.6	0	0.00	91.3	+0.3	0.09
				$+0.9-1.0$ $=-0.1$ P.E.$=\pm0.4$	1.23		$+1.4-1.4=0$ P.E.$=\pm0.44$	1.70
	S	Exp. value $(100-x)$	(S) I $\begin{cases} K=0.10277 \\ k\prime=0.56957 \end{cases}$			(S) II $\begin{cases} K=0.0018277 \\ k\prime=0.60611 \end{cases}$		
			Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
2	4.67	43.6	43.4	+0.2	0.04	42.5	+1.1	1.21
	9.33	55.9	57.0	−1.1	1.21	58.0	−2.1	4.41
	13.99	67.1	65.5	+1.6	2.56	66.6	+0.5	0.25
	18.66	70.6	71.4	−0.8	0.64	72.2	−1.6	2.56
	23.33	76.2	75.9	+0.3	0.09	76.0	+0.2	0.04
	27.99	79.2	79.2	−0.3	0.09	78.8	+0.3	0.09
				$+2.1-2.2$ $=-0.1$ P.E.$=\pm0.7$	4.63		$+2.1-3.7$ $=-1.6$ P.E.$=\pm0.9$	8.56

TABLE CLVI

Results of the application of T.N.N. (S) I to data obtained
by WEISS using protease of germinated barley
in decomposition for 2 hrs.

S	Exp. value	(S) I $\begin{cases} K=0.65767 \\ k'=0.28481 \end{cases}$			$\begin{pmatrix} \text{3rd datum} \\ \text{omitted} \end{pmatrix}$ (S) I $\begin{cases} K=0.66379 \\ k'=0.29175 \end{cases}$		
		Calc. value	Diff. Δ	Δ^2	Calc. value	Diff. Δ	Δ^2
I	78.5	78.0	+0.5	0.25	78.3	+0.2	0.04
2	84.4	84.2	+0.2	0.04	84.6	−0.2	0.04
3	85.7	87.4	−1.7	2.89	——	——	——
4	89.6	89.4	+0.2	0.04	89.9	−0.3	0.09
5	91.6	90.9	+0.7	0.49	91.3	+0.3	0.09
			+1.6−1.7 =−0.1 P.E.=±0.7	3.71		+0.5−0.5 =0 P.E.=±0.2	0.26

TABLE CLVII.

Results of the application of T.N.N. (S) I to data obtained
by WEISS using protease of germinated barley
in decomposition for 5 hrs.

S	Calc. value	(S) I $\begin{cases} K=0.43844 \\ k'=0.42762 \end{cases}$		
		Exp. value	Diff. Δ	Δ^2
I	63.8	63.6	+0.2	0.04
2	74.1	74.3	−0.2	0.04
3	79.7	80.1	−0.4	0.16
4	84.0	83.9	+0.1	0.01
5	86.8	86.6	+0.2	0.04
			+0.6−0.5=+0.1 P.F.=±0.2	0.29

Table CLVIII

Results of the application of T.N.N. (S) I and II to data obtained by Nemec using glycerophosphatase

S	Calc. value	(S) I $\begin{cases} K=0.83542 \\ k'=0.48892 \end{cases}$			$(S:0.1-5.0)$ (S) I $\begin{cases} K=0.86064 \\ k'=0.40299 \end{cases}$		
		Exp. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
0.05	72.82	64.10	+8.72	76.0384	——	——	——
0.1	49.50	53.58	—4.08	16.6464	45.68	+3.20	14.5924
0.25	28.99	37.71	—8.72	76.0384	32.19	—3.20	10.2400
0.50	20.38	25.39	—5.01	25.1001	22.34	—1.96	3.8416
1.0	13.50	14.61	—1.11	1.2321	13.79	—0.29	0.0841
2.5	5.59	4.93	+0.66	0.4356	6.26	—0.67	0.4489
5.0	2.78	1.46	+1.32	1.7424	2.26	+0.52	0.2704
			+10.70—18.92 =—8.22 P.E.=±3.86	197.2334		4.34—6.12 =—1.78 P.E.=±1.63	29.4774

(S) II $\begin{cases} K=0.07455 \\ k'=0.933385 \end{cases}$			$(S:0.1-5.0)$ (S) II $\begin{cases} K=0.075870 \\ k'=0.88375 \end{cases}$		
Calc. value	Diff. Δ	Δ²	Calc. value	Diff. Δ	Δ²
68.75	+4.07	16.5649	——	——	——
53.53	—4.03	16.2409	50.22	—0.72	0.5184
32.86	—3.87	14.9769	30.98	—1.99	3.9601
20.40	—0.02	0.0004	19.57	+0.81	0.6561
11.83	+1.67	2.7889	11.65	+1.85	3.4225
5.39	+0.20	0.0400	5.54	+0.05	0.0025
2.90	—0.12	0.0144	3.08	—0.30	0.0900
	+5.94—8.04 =—2.10 P.E.=±1.55	50.6264		+2.71—3.01 =—0.30 P.E.=±0.89	8.6496

TABLE CLIX

Applicable T.N.N. (S) equations for various enzymes and
substrates in decomposition taking the quantity
of substrate as a variable

Enzyme	Substrate	Data obtained by	Equation
Lipase			
Castor bean	Soy bean oil	NAKAJIMA	I
,,	Olive oil	JALANDER	I
Papain	Soy bean oil	NAKAJIMA	II
Emulsin	Amygdalin	TAMMANN	I
Invertase	Sucrose	BROWN	I
Amylase			Can not exist
Maltase	Maltose	HERZOG, BECKER AND KASARNOWSKI	I
Pepsin	Glycinin	NAKAJIMA	II
Pancreatin	,,	,,	II
Papain	,,	,,	I
Protease	Glutin	WEISS	I
Phosphatase	Glycerophosphate	NEMEC	II