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Dynamics of the glucose-insulin-glucagon system

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DYNAMICS OF THE GLUCOSE-INSULIN-GLUCAGON SYSTEM

BY

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ABSTRACT

A computer model for the Dynamics of the Glucose-Insulin-Glucagon System has been developed for a 17.5 kg canine using the Continuous Systems Modeling Progam (CSMP) for the 360 Computer System. The major body components controlling the glucose dynamics (liver, pancreas, body muscle, blood flow, and body fluid compartments) have been modeled in terms of either their production, absorption, or transport of glucose, and the concentration levels of both the hormones and substrates perfusing the body component. A set of mneumonics has also been developed to label the hundreds of constant and variable terms required to describe a complex system of this magnitude. The dynamic characteristic of the liver's glycogen storage capability has also been modeled in terms of stored glycogen and the blood plasma concentration levels of both glucose and insulin perfusing the liver.

Once the Glucose-Insulin-Glucagon System had been modeled, it was first tested under basal conditions with three different levels of glycogen stored in the liver to check the dynamics of the liver glycogen storage. As expected, when the stored glycogen was below the equilibrium level, blood glucose was converted to liver glycogen, and when the stored level was greater, glycogen was converted back to glucose and returned to the blood.

The Glucose-Insulin-Glucagon System model was then tested with an almost instantaneous glucose load of 8.75 grams of glucose, elevat-

ing the glucose concentration level to approximately 3.5 mg of glucose per ml of blood plasma. This high glucose concentration level returned exponentially over the next 120 minutes to the basal concentration level of 100 mg/100 ml, agreeing generally with in vivo test data.

The Glucose-Insulin-Glucagon System model was then tested by injecting insulin into the model at different rates over an extended period of time and observing the rate at which the glucose concentration fell, its final level, and the rate at which the glucose concentration level returned to the basal concentration level once the insulin load had been removed. Here again, there was generally good agreement with in vivo test data, not only for the glucose concentration dynamics but also for the rate at which glucose was produced by the liver during the period when insulin was being injected into the model.

APPROVAL OF THESIS

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BY

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FOR

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SECTION I

INTRODUCTION

Glucose is the primary energy source for the central nervous system (CNS), the principal component of which is the brain. An adequate and stable supply of glucose must be maintained by the body to keep the brain and all the body functions controlled by the CNS operating properly. Should the blood level fall below approximately 50 mg of glucose per 100 ml of blood (50 mg/100 ml) (30), a hypoglycemic condition results and many of the critical body functions are impaired. There is the possibility of convulsions, coma, and even death. When the body is unable to maintain the glucose concentration level below 150 mg/100 ml (29), the disease known as diabetes is indicated. Again, the disease finally affects the central nervous system with death resulting if not treated.

To maintain the blood glucose concentration at its basal level of approximately 100 mg/100 ml (16, 27) for the many varying conditions of stress, exercise, and food ingestion, the body provides many complex systems to control both the metabolism and synthesizing of glucose.

A model of the dynamics of the Glucose-Insulin-Glucagon System would be very beneficial for education, diagnostic, and research purposes. The many different effects that hormones and gluconeogenic substrates have upon the dynamics of the glucose concentration of the blood, the glycogen storage of the liver and the body muscle, and the

concentration levels of the various gluconeogenic substrates that are used by the liver to synthesize glucose can be studied without having to sacrifice animals or subject human life to the needless danger of in vivo testing.

The great computational power of today's highly sophisticated computer systems and the very abundant quantity of detailed medical research information that is available for each of the major body components, makes possible the modeling of the dynamics of the Glucose-Insulin-Glucagon System.

Today's digital computer systems permit the many time and function dependent quantities of a biological system of this magnitude to be calculated continuously on an almost instantaneous basis over the time interval of interest and then to be plotted graphically for visual use.

This thesis is an attempt to model the Glucose-Insulin-Glucagon System of a 17.5 kilogram dog using the medical research data that has been found, and the Continuous systems Modeling Program (CSMP) of the 360 Digital Computer. Once the system has been modeled, it will be exercised with glucose and insulin loads and the results compared with the in vivo canine test data obtained by Stanley M. Finkelstein, et al, (27) and R. C. de Bodo, et al (16).

The approach taken to develop the model for the dynamics of the Glucose-Insulin-Glucagon System was to determine the major body components (liver, pancreas, and body muscle) involved in controlling

the blood glucose dynamics and how these body components are affected by the concentrations of various hormones (insulin, glucagon, adrenaline, and glucocorticoids) and gluconeogenic substrates (amino acid, lactate, and glycerol) in maintaining the blood glucose concentration at approximately 100 mg/100 ml.

Since glucose is transported through the body by the blood, it was necessary to determine how the blood is distributed throughout the body and at what rates the blood is supplied to the major glucose body components as well as other parts of the body. It was also necessary to determine the pathway by which glucose travelled (blood plasma-interstitial fluid-intravellular fluid) when leaving the blood to be either converted to glycogen, lactate, or fat inside the cell or temporarily stored as glucose in the blood plasma or interstitial fluid. The volumes of blood plasma, interstitial fluid, and intracellular fluid together with estimates of the transport constants (admittances) of the capillary walls and cell membranes were used to establish system time constants which are the primary factors in the short term dynamics of the Glucose-Insulin-Glucagon System.

Once the major body components of the Glucose-Insulin-Glucagon System have been modeled, the Continuous System Modeling Program (CSMP) for the IBM System/360 was used to simulate the entire Glucose-Insulin-Glucagon System. CSMP provides a convenient format for the simulation of a differential analog system on the IBM 360 System.

To facilitate converting the Glucose-Insulin-Glucagon System into the CSMP format, a set of mnuemonics was developed to represent the many input and output variables for all of the functions involved in the dynamics of the Glucose-Insulin-Glucagon System.

After the CSMP model of the Glucose-Insulin-Glucagon System was developed, it was exercised by providing both glucose and insulin loads and comparing the simulation outputs with in vivo test results.

SECTION II

PHYSIOLOGY

The basal blood glucose concentration level of approximately 100 mg/100 ml for a canine is maintained at this level by a number of biological mechanisms which are capable of either supplying glucose to or taking glucose from the blood. The blood glucose concentration will rarely go above 150 mg/100 ml in healthy systems even after a heavy carbohydrate or protein meal, and will seldom fall below 60 mg/100 ml, even after strenuous physical exercise.

Glucose Sources

Glucose is capable of being supplied to the blood by three major sources:

1. Food ingestion; carbohydrates and protein
2. Gluconeogenesis
3. Glycogenolysis

Both food ingestion and glycogenolysis are capable of increasing the blood glucose concentration level in a matter of minutes (18), but are not capable of sustaining the increased glucose concentration. Gluconeogenesis is the primary source of glucose when no food is being digested, but is not capable of a quick response to blood glucose requirements, usually requiring fifteen to thirty minutes for glucose derived from lactate (24) and one to two hours for the glucose derived from amino acids (62) (see Figures 1, 2, and 3).

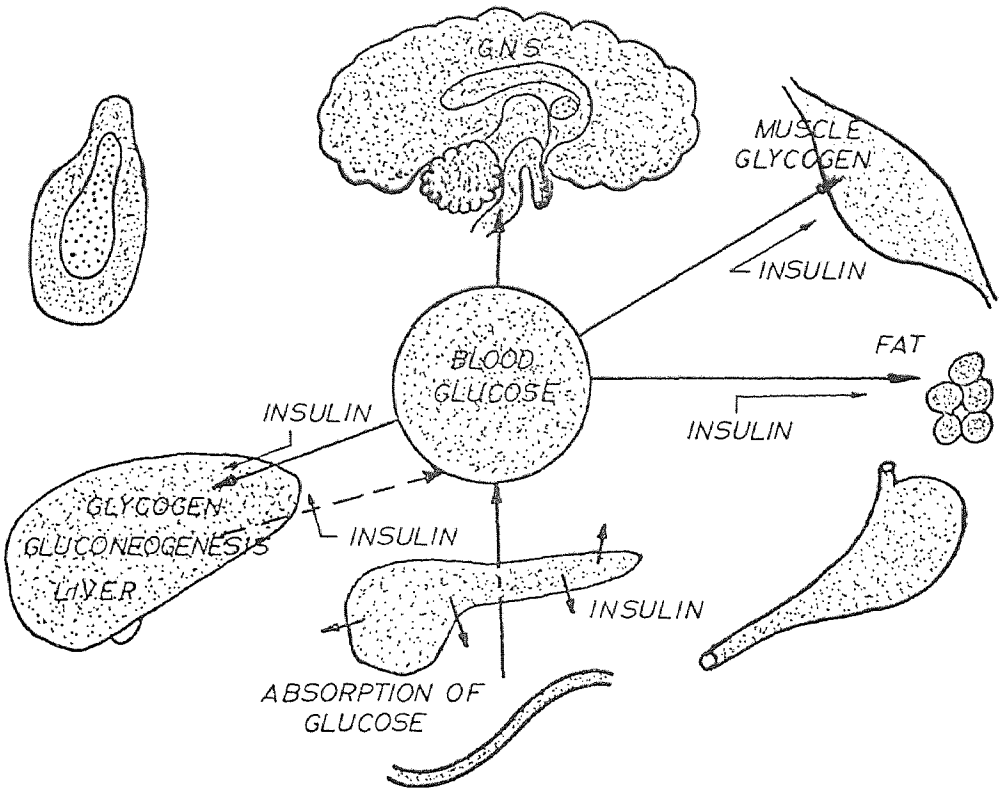

FIGURE 1 ENDOCRINE CONTROL OF GLUCOSE METABOLISM*

FIGURE 1 illustrates metabolism of glucose during periods of dietary intake of excess carbohydrate. The secretion of insulin promotes the snythesis of hepatic and muscle glycogen, the synthesis of fats and depresses hepatic gluconeogenesis. FIGURE 2 depicts the change in the situation at the onst of hypoglycaemia. Insulin production declines and muscle and fat tissues are thus deprived of glucose. There is an outpouring of adrenaline from the adrenal medulla which acts at various sits to raise the blood sugar. (a) hepatic phosphorylase is activated; (b) there is a release of lactate from muscle and glycerol from fat tissues which act as raw material for hepatic gluconeogenesis; (c) activates, via the hypothalamus, the secretion of A.C.T.H. by the anterior pituitary gland. There is also secretion of glucagon from the pancreas which reinforces the action of adrenaline on hepatic phosphorylase. FIGURE 3 shows later stages in the response to hypoglycaemia. A.C.T.H. from the anterior pituitary gland activates the adrenal cortex which secretes glucocorticoid hormones. These hormones act in various ways to maintain supplies of glucose for the C.N.S.; (a) they antagonize the uptake of glucose by muscle and fat cells; (b) cause a release of amino acids from muscle which act as raw material for hepatic gluconeogenesis; (c) increase the amounts of those hepatic enzymes concerned in gluconeogenesis.

*From Clegg & Clegg (13).

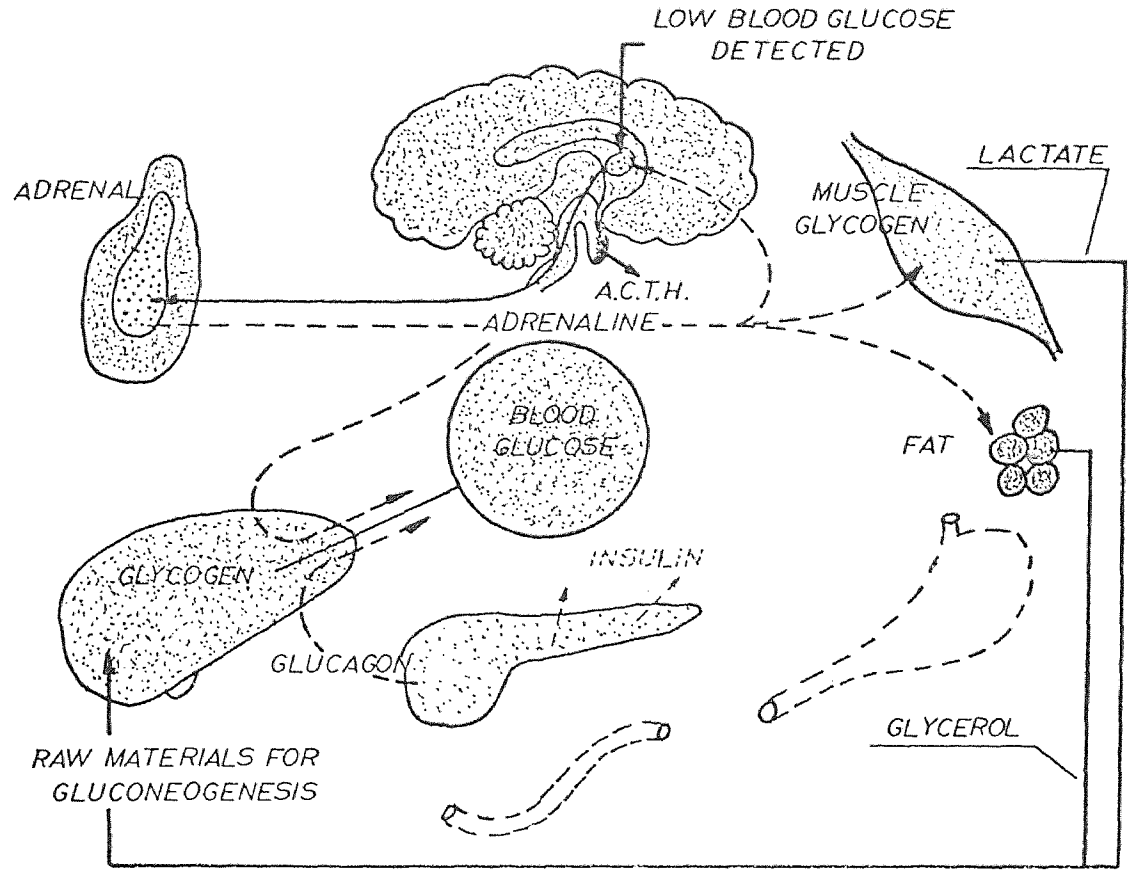

FIGURE 2 ENDOCRINE CONTROL OF GLUCOSE METABOLISM*

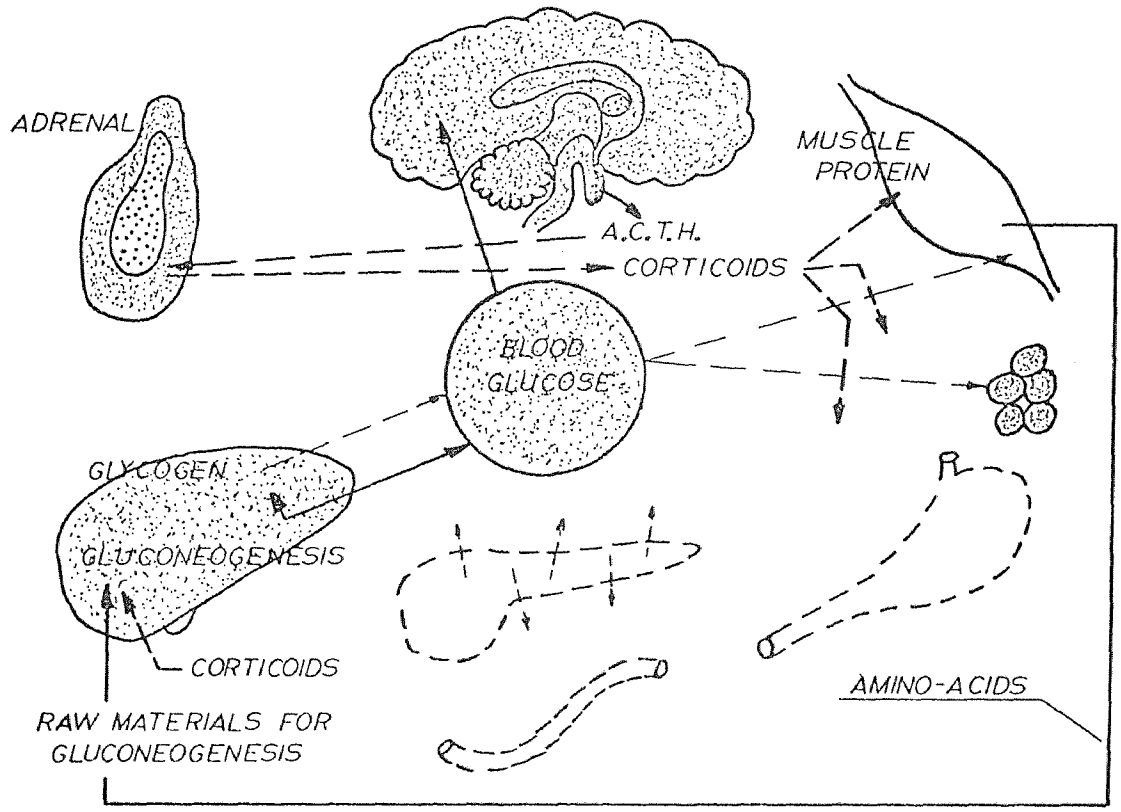

FIGURE 3 ENDOCRINE CONTROL OF GLUCOSE METABOLISM*

*From Clegg & Clegg (13).

Food ingestion. Ingested food carbohydrates are converted directly to glucose by the digestion process and are absorbed by the blood in the alimentary tract. The resulting increased blood glucose concentration is then available for conversion into glycogen in either the liver or body muscle, fat in adipose tissue, or lactate by the red blood cells. All of these conversions are influenced in varying degrees by the insulin concentration level of the blood.

Food protein is digested and converted into amino acids by the alimentary tract. Amino acids, which are one of the major gluconeogenic substrates, are transported by the blood from the alimentary tract to the liver where they are converted to glucose by gluconeogenesis.

Gluconeogenesis. Gluconeogenesis is the biological mechanism by which the liver is capable of converting the gluconeogenic substrates of lactate, amino acids, and glycerol into glucose. The rate at which glucose is produced from gluconeogenesis is determined by the concentration levels of the hormones: insulin, glucagon, adrenaline, and glucocorticoids. By affecting both the liver and the origin of the gluconeogenic substrates, insulin is capable of inhibiting gluconeogenesis while glucagon, adrenaline, and glucocorticoids all increase the rate of gluconeogenesis.

Glycogenolysis. Glycogenolysis is the biological mechanism whereby the glucose that has been stored as glycogen in the liver and body muscle is converted back to glucose. In the liver, the glycogen

is converted back to glucose under the influence of glucagon while the glycogen stored in the body muscle is first converted to lactate under the influence of adrenaline and then returned to the blood and converted to glucose in the liver by gluconeogenesis.

The glycogen stored in the liver is capable of being very rapidly converted to glucose by the action of the hormone glucagon, approximately 10 gm/hr for a 17.5 kg canine (22, 63). Glycogenolysis in body muscle, release of lactate due to the hormone adrenaline, is a relatively more time-consuming and slower process in the production of glucose due to both the nature of muscle glycogenolysis and the subsequent gluconeogensis in the liver required to convert lactate to glucose (23).

Use of Glucose

The primary uptake of glucose from the blood is by the central nervous system (CNS) with most of the glucose being supplied to the brain. Glucose is supplied to the CNS at an almost constant rate except under the conditions of prolonged fast when body protein is conserved and energy sources other than glucose are made available to the CNS. Glucose is also removed from the blood resulting in synthesis of glycogen in both the liver and body muscle. In body muscle, insulin is involved in an active transport mechanism, (see Figure 4), that carries glucose across the cell membrane from the interstitial fluid into the intracellular fluid of the cell where it is converted to glycogen.

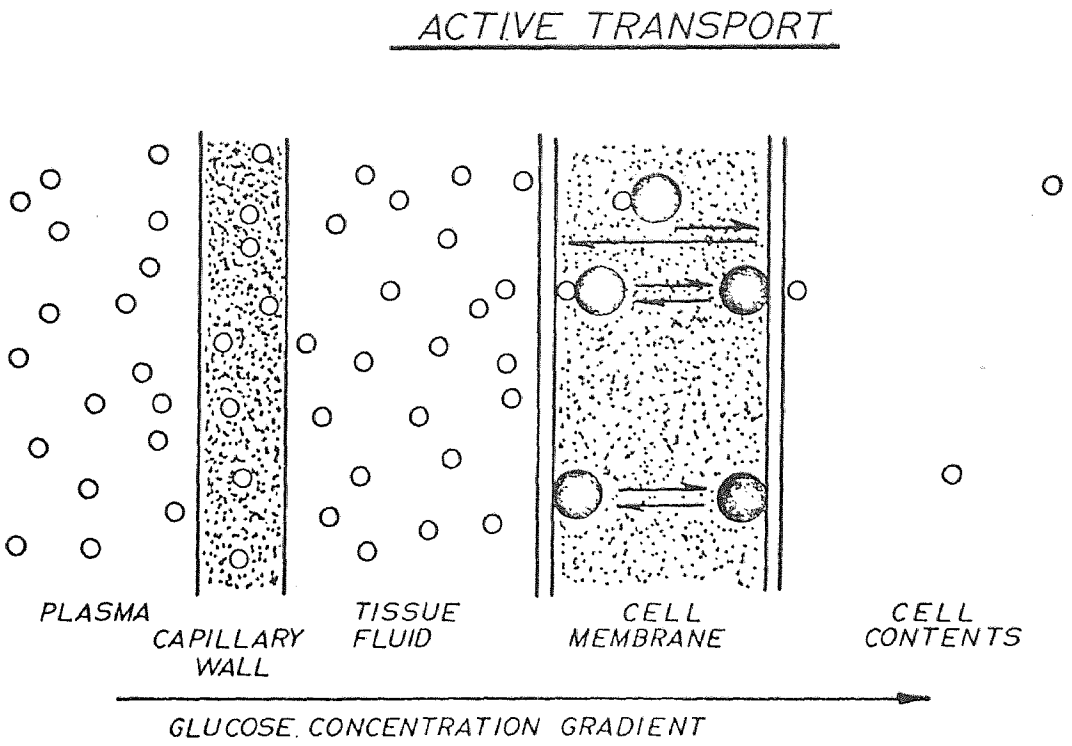

FIGURE 4*

Body Components

Liver. The liver is the primary body component for maintaining the blood glucose level at approximately 100 mg/100 ml. The liver of a 17.5 kg canine weighs approximately 550 gm (1). It is capable of converting glucose to glycogen at a maximum rate of about 8 gm/hr (18) and can store 19 grams of glycogen (16) which can be converted back to glucose at a near maximum rate of 10 gm/hr (22, 63) when needed to quickly increase the blood glucose concentration.

The supply of blood carrying glucose, gluconeogenic substrates, and hormones to the liver is by way of the portal vein and the

* From Clegg & Clegg (13).

hepatic artery (see Figure 5). The portal vein brings blood to the liver at a rate of approximately 532 ml/min from the stomach, intestines, pancreas, and spleen, while the hepatic artery's blood supply of approximately 276 ml/min is directly from the cardiac output by way of the descending aorta.

Under steady state (short term fasting period of twelve to twenty-four hours) the liver produces glucose by means of gluconeogenesis at a rate of 1.4 gm/hr (see Figure 6). Of this 1.4 gm/hr, 0.4 gm/hr is derived from the gluconeogenic substrate lactate which was produced by the red blood cells from blood glucose in what is known as the "Cori" cycle. The remaining 1.0 gm/hr of liver glucose is derived from the gluconeogenic substrates of amino acids and glycerol at rates of 0.8 gm/hr and 0.2 gm/hr, respectively (8). The kidney glucose contribution is 0.4 gm/hr (20).

The rates of glucose production from both gluconeogenesis and glycogenolysis, and the rate at which glucose is converted to glycogen are controlled by many factors; the primary factors being the blood concentration levels of the gluconeogenic substrates and the hormones insulin and glucagon. Over a short period of time, less than thirty minutes, insulin and glucagon dominate in the control of the blood glucose concentration level, while over longer periods of time, particularly during fasting, these three factors plus the blood concentration levels of adrenaline and glucocorticoid control the rate of glucose production in the liver and; consequently, also the blood glucose concentration level.

BLOOD CIRCULATION

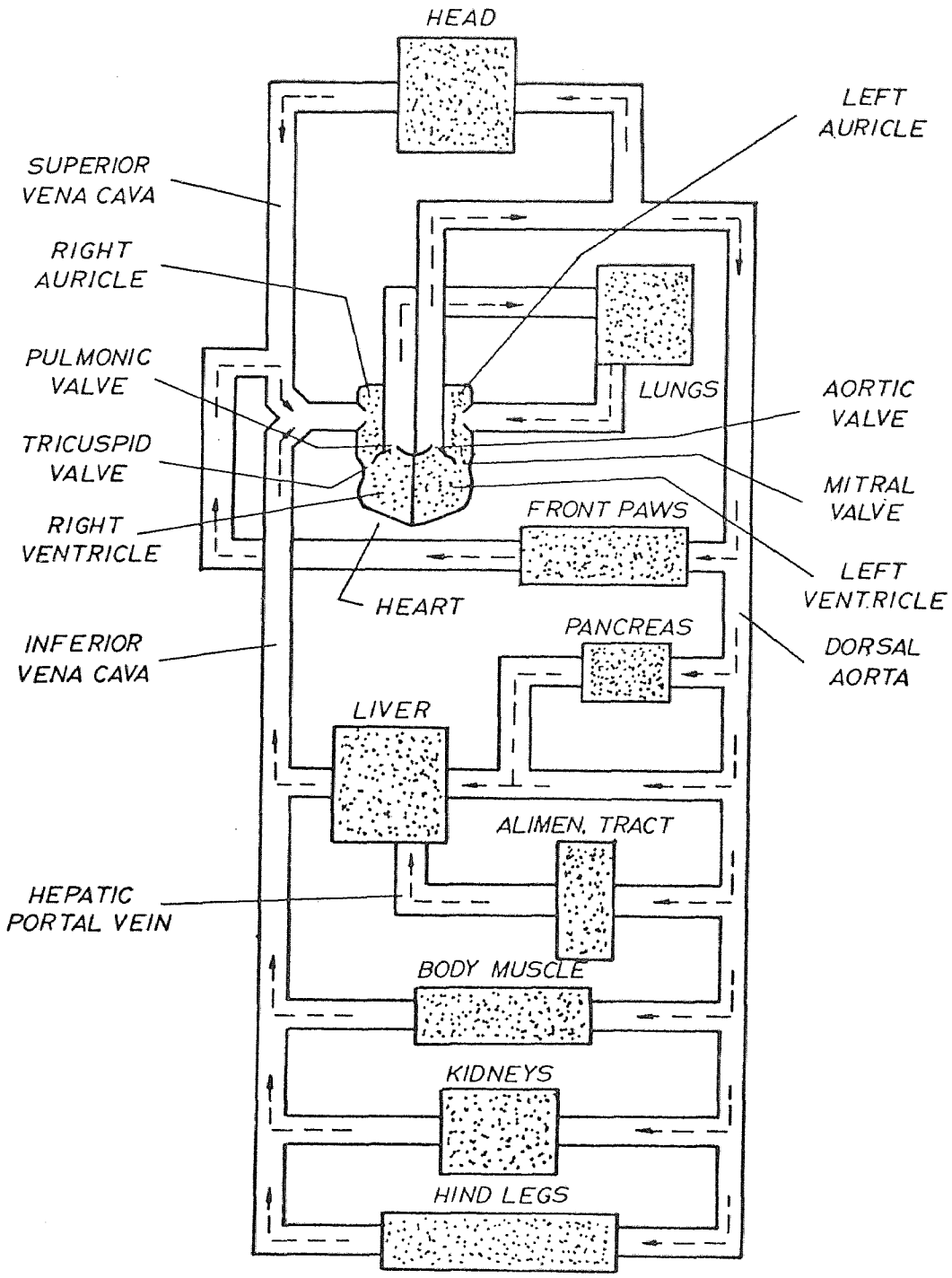

FIGURE 5

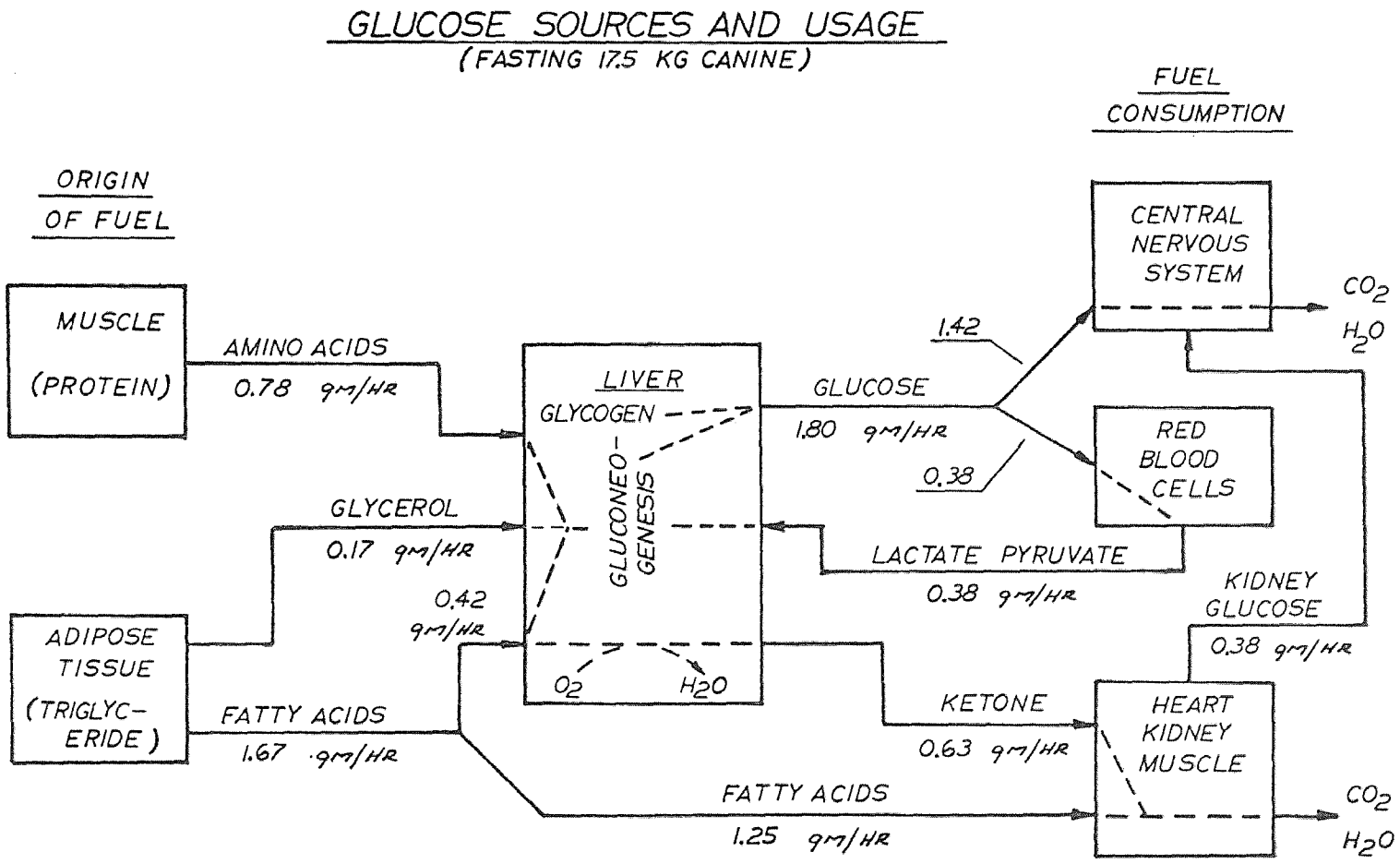

FIGURE 6*

* Extrapolated from Data of Cahill (8).

Pancreas. The function of the pancreas in the regulation of the blood glucose concentration level is to supply the hormones insulin and glucagon to the blood in response to the blood glucose concentration level. High glucose concentration levels will cause increased amounts of insulin and decreased amounts of glucagon to flow from the pancreas into the blood of the portal vein. Low blood glucose concentration levels will have the opposite effect. Insulin output from the pancreas will be decreased and the glucagon output increased.

The pancreas of a 17.5 kg canine weighs approximately 58 grams, has a blood flow through it of approximately 46 ml/min (34) and has basal insulin and glucagon outputs of approximately 170 ng/min and 15 ng/min, respectively, for basal blood concentration levels of 0.5 ng/ml[1] for insulin and 0.06 ng/ml for glucagon. The pancreatic outputs of both insulin and glucagon to a step input of glucose is biphasic, meaning that the initial output response is an overshoot followed by a lower steady state output level that is a more linear function of the glucose concentration level.

High blood insulin concentration levels affect the blood glucose concentration level by reducing the rate of gluconeogenesis in the liver, by increasing the rate at which glucose is taken up in the body muscle to be converted to glycogen, and also by inhibiting the output of the gluconeogenic substrate amino acids. High blood concentration levels of glucagon increase the rates of both gluconeo-

[1] See Derivation of Pancreas Model for details about flow rates and basal blood concentration level for insulin and glucagon.

genesis and glycogenolysis in the liver causing the blood concentration of glucose to also increase.

Body muscle. Body muscle accounts for approximately forty per cent of the total weight of a canine.[2] The three main functions of body muscle in the dynamics of the Glucose-Insulin-Glucagon System are:

1. Convert glucose, which has entered the muscle cells under the influence of insulin, into glycogen during periods of high glucose concentration levels in the blood. The body muscle is capable of storing approximately 38 grams[3] of glycogen.
2. To convert the stored glycogen back to lactate under the influence of adrenaline during periods of low blood concentration levels of glucose, the lactate to be converted to glucose in the liver by gluconeogenesis. Adrenaline is secreted by the adrenal medulla when the CNS senses a low concentration level of glucose in the blood.
3. To convert muscle protein to amino acids under the influence of glucocorticoids, again during the periods

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[2]The forty per cent figure for the body muscle of a 17.5 kg dog is based on body muscle comprising forty per cent of the skeleton weight of a 70 kg man. Posefsy, et al, Amino Acid Balance Across Tissue of the Forearm in Postabsorptive Man, Journal of Clinical Investigation, Volume 48, 1969, page 2279

[3]Thirty-eight grams of body muscle glycogen storage is extrapolated from the 150 grams of body muscle glycogen storage capability for a 70 kg man. Cahill, Starvation in Man, The New England Journal of Medicine, March, 1969, page 669.

of low blood concentration levels of glucose, with the amino acids being converted to glucose in the liver by gluconeogenesis. This is a slow process requiring several hours (62) primarily due to the action of glucocorticoids on muscle protein and the sequence of events that must take place prior to this action (sensing of low blood glucose concentration and release of CRF by the hypothalamus--the secretion of ACTH from the anterior pituitary due to CRF--and then the release of glucocorticoids from the adrenal cortex in response to ACTH). Adrenaline also acts along this same pathway to reinforce the secretion of glucocorticoids from the adrenal cortex (see Figure 7.)

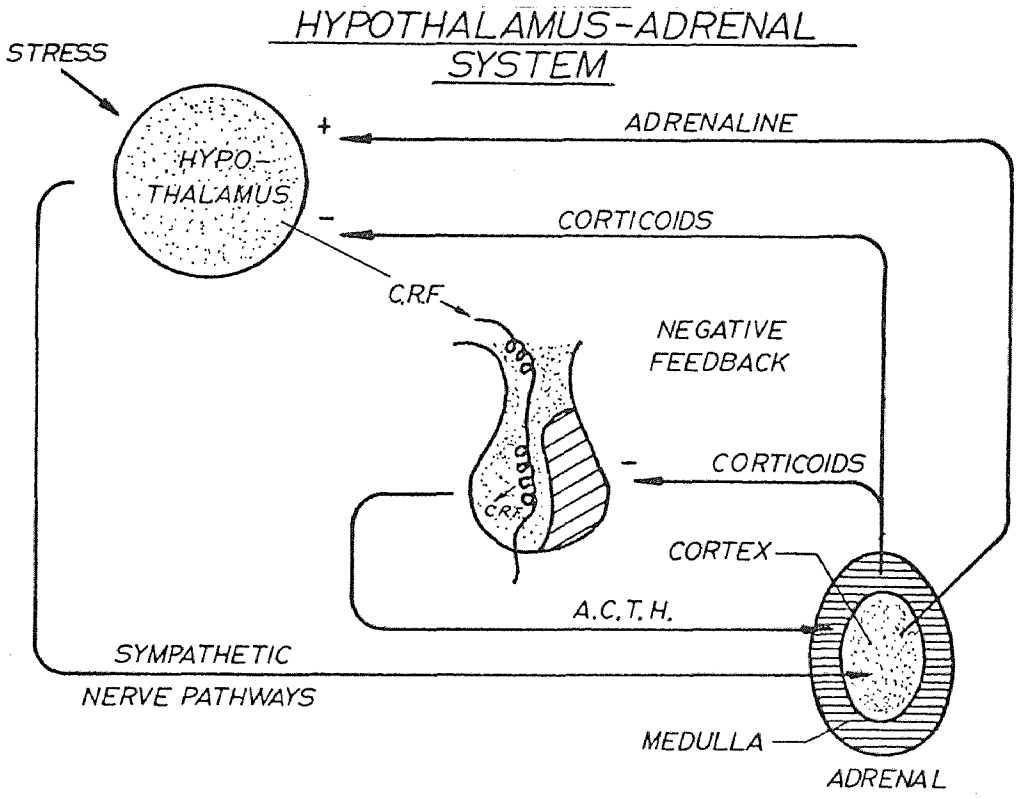


FIGURE 7 *

*From Clegg & Clegg (13).

Substrates

Amino acids. The gluconeogenic substrates--amino acids, lactate, and glycerol--supply the major portion of the raw materials used by the liver to produce glucose. Of the twenty odd amino acids found in the blood, only alanine is significant in gluconeogenesis and the regulation of the blood glucose concentration. Amino acids enter the blood directly from the digestion of protein in the alimentary tract and also from the breakdown of muscle protein. The muscle protein source of amino acid is regulated by both insulin and glucocorticoids. Insulin works to decrease the supply of amino acids from body muscle while glucocorticoids increase the amino acid supply. The effects of insulin requires only thirty to sixty minutes (56) while glucocorticoids require one to two hours (62) and appears to be the primary control of blood glucose concentration levels during short term fasting (less than twenty-four hours).

Lactate. The gluconeogenic substrate lactate also has two sources, the first source being the breakdown of glycogen stored in body muscle under the influence of adrenaline. This is a relatively fast process requiring less than fifteen minutes (26). The second source of lactate is the red blood cells. The red blood cells extract glucose from the blood plasma, convert this glucose to lactate, and then return the lactate to the blood plasma to be converted back to glucose by the liver. This cycle is known as the "Cori" cycle and accounts for approximately twenty per cent of the total steady state output of glucose produced by gluconeogenesis.

Glycerol. The glycerol contribution to the steady state glucose output from the liver is approximately ten per cent. The major source of glycerol is adipose tissue (fat) and is affected by the blood concentration level of adrenaline. The major contribution of glycerol to the production of glucose is during the long term fasting when the normal basal blood concentration level of glycerol is increased by almost a factor of three and becomes one of the major gluconeogenic substrates.

Body Fluids

Blood. Glucose, the gluconeogenic substrates, and the hormones that control all the body functions that regulate the blood glucose concentration level are transported throughout the body by the blood and the circulatory system. The blood volume for a 17.5 kg canine is approximately 1600 ml with the cardiac output being 2200 ml/min. The blood flow to the liver of approximately 800 ml/min is by way of the alimentary tract and the hepatic artery. The alimentary tract provides approximately twenty-five per cent of the cardiac output to the liver, and the hepatic artery twelve per cent. Blood flows out from the liver through the hepatic vein and is returned to the heart by way of the inferior vena cava. The other major body components involved in glucose dynamics are supplied blood from the descending aorta, and the subclavian and carotid arteries. Blood is returned to the heart through the superior and inferior vena cava. The blood circulatory path through the body is shown in Figure 5.

The blood flow rates and the approximate distributed blood vol-

umes for the major body components are shown in Table I.

Interstitial and intracellular fluids. The site of the chemical reactions involved in both the metabolizing and synthesizing of glucose is inside the cell, but before the glucose, gluconeogenic substrates, and hormones involved in the Glucose-Insulin-Glucagon dynamics can reach the interior of the cell, they must pass through the capillary walls that separate the blood circulatory system from the body's interstitial fluid, and then pass through the outer membrane of the cell that separates the interstitial fluid from the intracellular fluid of the cell (see Figure 8). The ratio of blood to interstitial fluid to intracellular fluid is approximately 1:2.4:7, respectively, (13, 28) (see Figure 9). These body fluid compartments, or reservoirs, are significant in the short term (thirty minutes to two hours) dynamics of the Glucose-Insulin-Glucagon System.

Transport. The transport of glucose, gluconeogenic substrates, and hormones across the capillary walls and cell membranes are for the most part at fixed rates, varying only as a function of body component and substance being transported, with the exception of the transport of glucose across the cell membranes of the body muscle. Insulin which is secreted into the blood by the pancreas during periods of high blood glucose concentration levels causes glucose to be transported across the cell membranes from the interstitial fluid into the intracellular fluid of the cell at an increased rate by what is known as an active transport system (see Figure 4).

BODY PARAMETERS

Parameter / Body Component	Blood Flow	Blood Volume	Blood Plasma	Interstitial Fluid	Intracellular Fluid	Weight of Body Component	Dry Weight	Admittance	
								K12	K23
Units	ml/min	ml	ml	ml	ml	gm	gm	(( )/min)/(( )/ml)	
Total	2187	1619	1177	2840	7966	17500	1575	991.8	429.8
Head	322	38	23	74	204	366	41	76.6	38.3
Front Paws	230	180	132	346	980	1750	198	116.0	50.2
Heart	2187	202	148	48	126	450	51	30.4	8.5
Lungs	2187	314	231	675	1818	2788	313	198.3	93.7
Body Mus.	69	180	133	347	980	1750	198	116.2	50.2
Stomach	115	30	22	53	166	292	33	19.2	8.3
Intestine	303	59	35	84	325	583	65	38.4	6.3
Pancreas	46	6	4	10	33	58	7	4.0	1.8
Spleen	68	9	7	17	46	82	9	5.6	2.3
G. I. Tract	532	104	68	164	570	1015	114	67.2	18.7
Hep. Art.	276								
Liver	808	56	41	109	305	550	62	36.0	17.1
Kidneys	416	18	13	35	99	181	20	12.0	5.0
Hind Legs	111	359	264	714	1960	3500	393	230.3	101.0
Other	231	168	124	328	921	1650	185	108.8	47.1

TABLE I

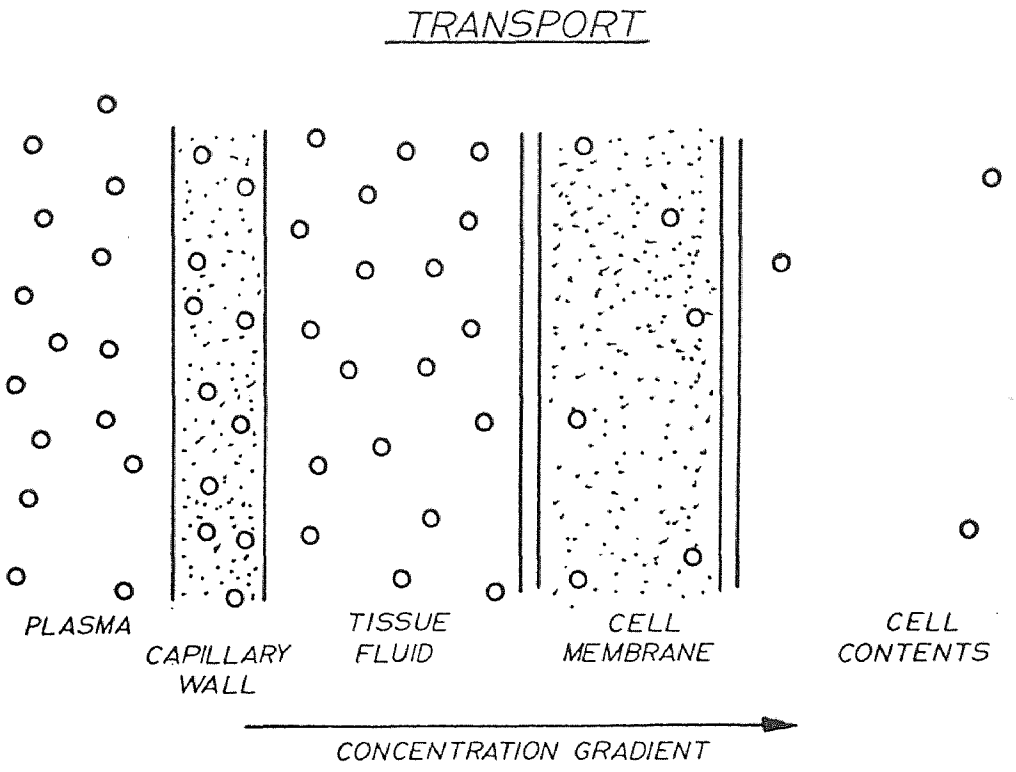


FIGURE 8

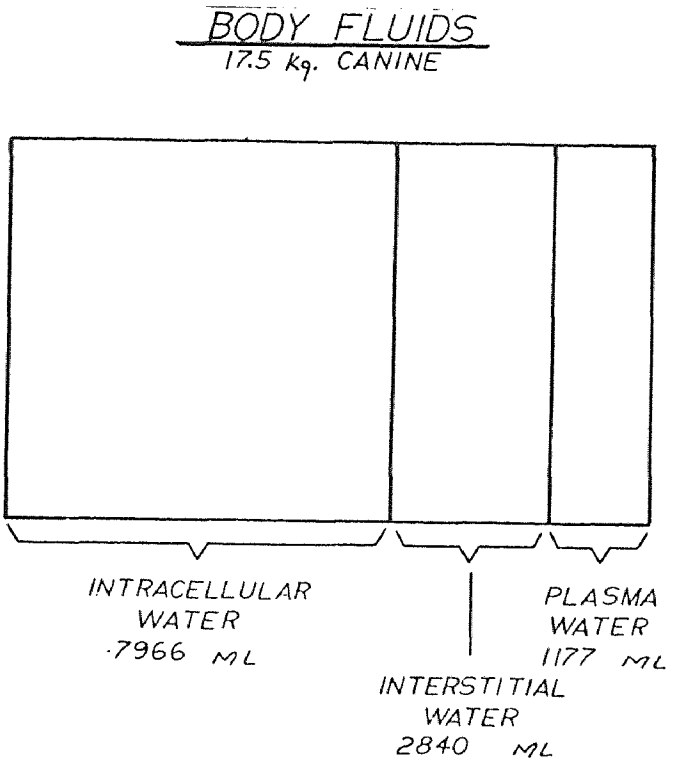


FIGURE 9

Active transport is the process by which a substance is transported across a membrane by another substance. This process involves energy and is capable of transporting substances against high concentration gradients. The potassium-sodium concentration gradient between the red blood cells and blood plasma is an example of active transport in action. The red blood cell contains twenty times more potassium than the blood plasma, while the blood plasma contains twenty times more sodium than the red blood cell.

SECTION III

DEVELOPMENT OF OVERALL BODY MODEL

The Glucose-Insulin-Glucagon dynamics for a 17.5 kg canine involves the transport of glucose, substrates, and hormones to all parts of the body by way of the circulatory system. The circulation through the major body components is shown in Figure 10. The physiological parameters for the blood flow, blood volume, interstitial fluid, intracellular fluid, organ dry weight, and admittance for the major body components and the circulatory system are listed in Table I. These parameters have been derived, for the most part, from data in the following references (1, 8, 14, 20, 30, 34, 57) and by extrapolation of these data with the following assumptions and facts:

1. Body fluid (blood, interstitial and intracellular) accounts for approximately seventy-one per cent of total body weight.
2. The ratio of blood, interstitial fluid, and intracellular fluid is approximately 1.0 : 2.4 : 7.0.
3. Body muscle accounts for approximately forty per cent of the total body weight.
4. Tissue dry weight accounts for approximately nine per cent of the total body weight.
5. Skeleton accounts for approximately twenty per cent of the total body weight.

GLUCOSE-INSULIN-GLUCAGON BLOCK DIAGRAM

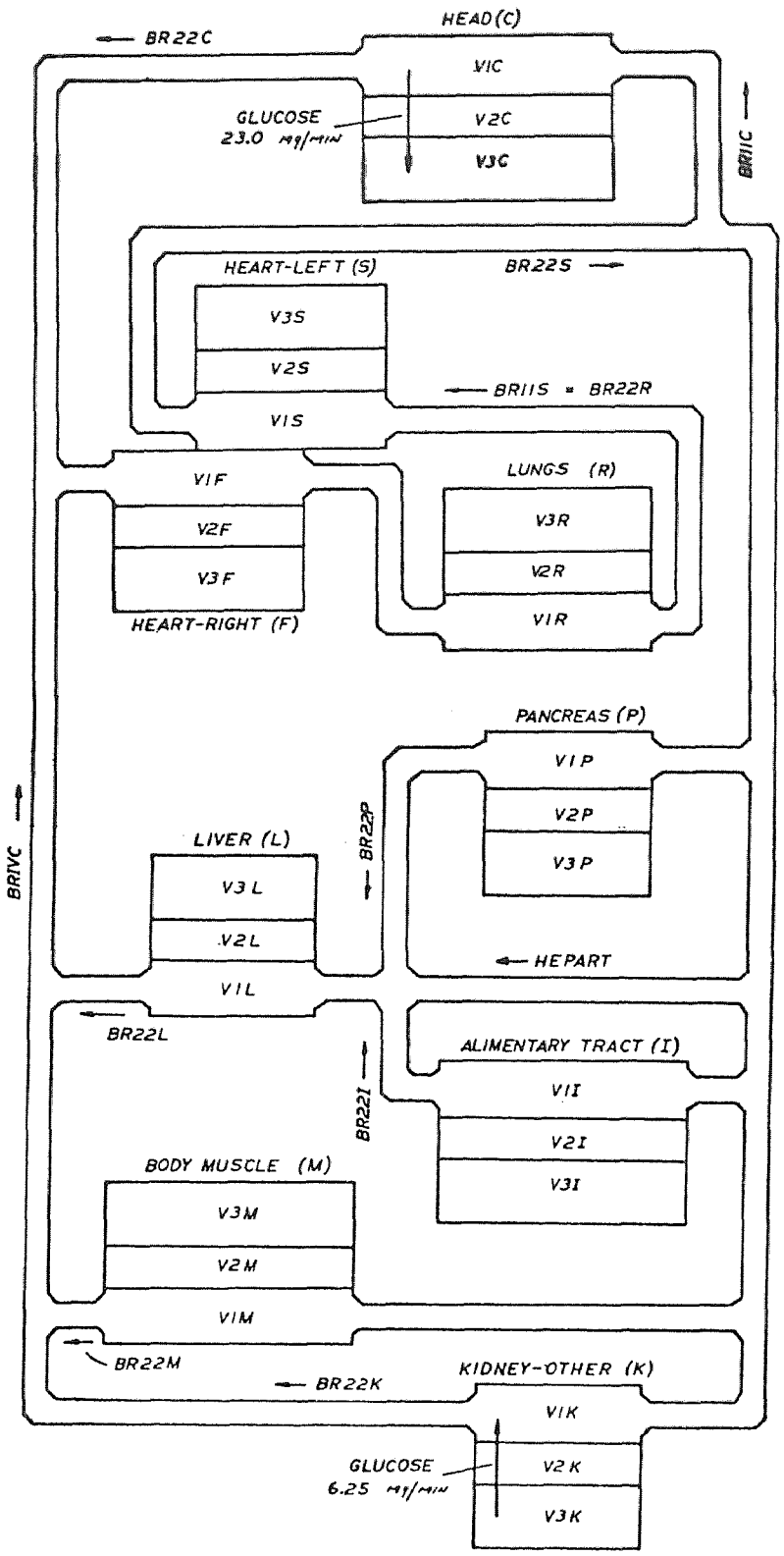


FIGURE 10

6. The disappearance rate for both insulin and glucagon is approximately ten per cent per minute.
7. Blood hematocrit (ratio of red blood cell volume to the total blood volume) is approximately twenty-eight per cent.

The last entry in Table I "Other" has been included to account for the difference between the entry "Total" and the sum of the body component entries.

Figure 10 shows the major body components that have been used to model the Glucose-Insulin-Glucagon System. In this figure, Body Muscle is meant to also include the front paws and hind legs of the canine, while the body component labeled "Kidney-Other" combined both the "Kidney" and "Other" entries of Table I. The right side of the heart, the lungs, and the left side of the heart have been drawn serially to better visualize the flow of blood through these organs.

Although the interconnecting arteries and veins between the major body components are shown as having volume in the Glucose-Insulin-Glucagon Model Block Diagram (Figure 10), the total body blood volume of 1619 ml has been apportioned to the major body components on the basis of organ weight. Adjustment of the blood volume apportionment has been made where data indicated that the body component had either a higher or lower than average blood to weight ratio. Such is the case for the heart. The V1 compartment for each of the major body components represents the plasma part of the blood that has

been apportioned to each of the major body components.

Each of the major body components in the Glucose-Insulin-Glucagon Model Block Diagram of Figure 10 has been divided into three sections, V1, V2, and V3 to represent the volumes of the plasma, interstitial fluid, and the intracellular fluid, respectively. The values of these volumes are listed in Table I. The line separating V1 from V2 represents the membrane (capillary wall) that separates the plasma from the interstitial fluid. This membrane has a transport constant (admittance) K12 associated with it for each of the substances, glucose, hormones, and substrates, that permeates through this membrane. Likewise, the line separating V2 from V3 represents the cell membrane separating the interstitial fluid from the intracellular fluid of the cell. Associated with this membrane is a transport constant (admittance) K23 for each of the substances that permeates this membrane.

The overall body admittance for glucagon (K12 in series with K23) has been determined from the data of J. L. Chiasson, M.D. and Associates (11), and J. P. Palmer, M.D. and Associates (53). From the data of Chiasson, glucagon input rates of 50, 25, and 15 ng/kg/min resulted in glucagon concentration levels of 5.06, 2.45, and 1.7 ng/ml, respectively. The glucagon admittance was calculated from:

$$Y = AR/AC \qquad (1)$$

where:

Y = overall body glucagon admittance (ng/min)/(ng/ml)

AR = glucagon input rate for 17.5 kg canine (ng/min)

AC = glucagon concentration (ng/ml).

For three sets of data from Chiasson:

Y - (50 x 17.5)/5.066 = 172

Y = (25 x 17.5)/2.45 = 178

Y = (15 x 17.5)/1.7 = 154

Average admittance: Y = 168 (ng/min)/(ng/ml).

From the data of Palmer (see Figure 11), where the glucagon dis-

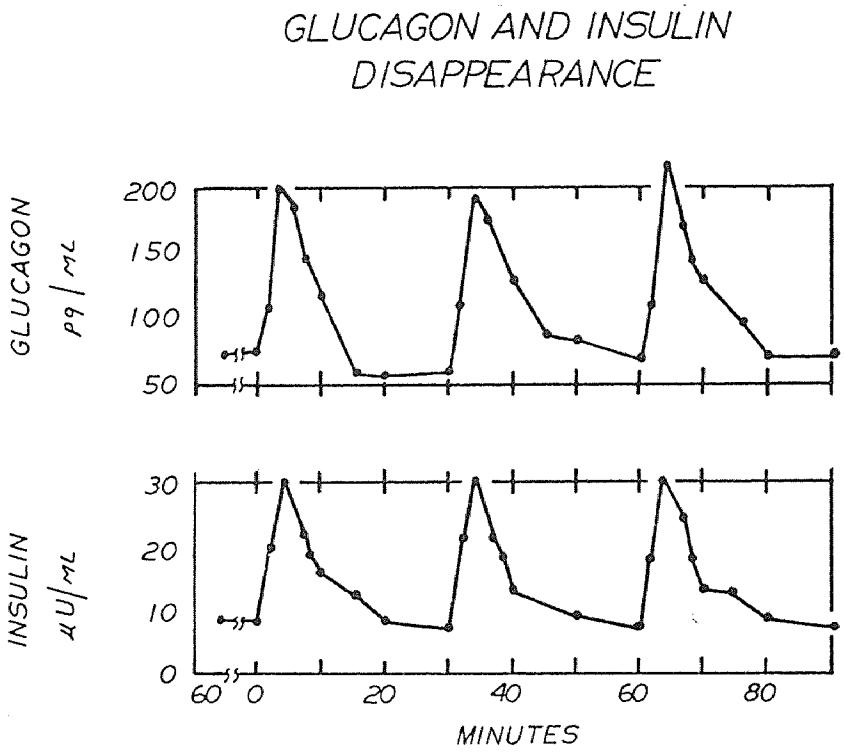
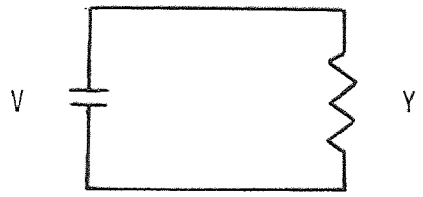


FIGURE 11

appearance time constants (τ) are approximately ten minutes, the electrical analog for glucagon disappearance transient becomes:



$$AW = (AC_1)\ (V)\ (e^{-(Y/V)t}) \qquad (2)$$

$$\tau = V/Y \qquad (3)$$

where:

AC_1 = initial glucagon concentration (ng/ml)

AW = total weight of glucagon in volume (V) (ng)

V = total volume of plasma and interstitial fluid in 17.5 kg canine (ml)

Y = overall body glucagon admittance (ng/min)/(ng/ml)

τ = glucagon disappearance time constant (min).

Since:

$\tau = V/Y$

for V = 4017 ml, τ = 10 min

Y = 4017/10 = 402 (ng/min)/(ng/ml).

There is a greater than two to one difference between the overall body glucagon admittances calculated from the data of Chiasson and Palmer, 168 and 402 (ng/min)/(ng/ml), respectively. The probable reason for the two to one difference between the two calculated values

for the overall body glucagon admittances are:

1. The data of Chiasson was obtained by administering glucagon, over a substantial period of time at rates which produced glucagon concentrations that were very high compared to physiological levels, thus, reaching a steady state condition and also minimizing the binding effect that glucagon has with tissue.
2. For the data of Palmer, glucagon was secreted from the pancreas over a relatively short period of time in response to a pulse of arginine, thus, the binding effect between glucagon and tissue is significant since it lowers the glucagon concentration by removing glucagon from the blood plasma and interstitial fluid. This causes the overall body glucagon admittance (calculated from transient data) to be higher than when calculated from the steady state data of Chaisson.

Since the conditions under which the Glucose-Insulin-Glucagon Model will be tested fall somewhere between the high level steady state conditions of Chiasson's data and low level transient conditions of Palmer's data, the average of the two overall body glucagon admittances will be used.

Averaging the glucagon admittances determined from the data of Chiasson and Palmer, the overall body glucagon admittance becomes:

$$Y = (168 + 402)/2 = 285 \text{ (ng/min)/(ng/ml)}$$

The overall body glucagon admittance is the parallel combination of all the series glucagon admittance (AK12)[1] between the plasma and the interstitial fluid, and the glucagon admittance (AK23) between the interstitial fluid and the intracellular fluid of the cell. Since data was not found which would permit the determination of (AK12 and AK23), and many references (6, 13) have been made to the fact that equilibrium is reached very quickly between the plasma and interstitual fluid concentrations, it has been assumed that the (AK12) admittance was twice as great as the (AK23) admittance. For an overall body glucagon admittance of 285 and (AK12) twice the value of (AK23), then:

$$\begin{matrix} AK12 = 850 \\ AK23 = 425 \end{matrix} \quad \text{(ng/min)/(ng/ml)}$$

From the data of Palmer, the insulin disappearance curves are very similar to the disappearance curves for glucagon; also from the data of Norfleet (51), the basal secretion of insulin was approximately ten times that of glucagon, indicating that the insulin and glucagon overall body admittances are equal since the basal concentration of insulin is approximately ten times that of glucagon, 0.5 ng/ml, 0.06 ng/ml, respectively. For these reasons, and for the lack of additional insulin data, the admittances that were determined for glucagon have been used for the insulin admittances.

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[1] Explanation of mneumonics appears in Section VII.

Since the major disappearance of glucose from the system is either by way of the brain or body muscle, the glucose admittances (GK23C, GK23M) between the interstitial and intracellular fluids of these organs are the only interstitial to intracellular fluid admittances used. The admittances for the brain have been determined on the basis of 23.0 mg/min of glucose being absorbed in the intracellular fluid (V3C) of the brain at a glucose concentration (GC3C) of 0.0 mg/ml (4, 8, 31) and a glucose concentration (GC2C) of approximately 0.6 mg/ml in the interstitial fluid of the brain. The resulting admittances (GK12C) and (GK23C) have been calculated to be 76.6 and 38.3 (mg/min)/(mg/ml), respectively. The (GK23M) admittance for muscle involves active transport (a function of insulin) and is described in the section on Development of Muscle Model (Section VI). The glucose admittances between the plasma and the interstitial fluid for the other body components was made equal to the corresponding glucagon admittance simply for the lack of data to make a more valid determination.

SECTION IV

DEVELOPMENT OF LIVER MODEL

The liver is the primary body component in controlling the blood glucose concentration. The liver of a 17.5 kg canine weighs approximately 550 gm, has a blood flow through it of approximately 800 ml/min, and is capable of storing approximately 19 gm of glycogen.

During periods of low blood glucose concentration, the liver supplies glucose to the blood by the processes of glycogenolysis (glycogen to glucose) and gluconeogenesis (substrates to glucose). Both of these processes are mediated by the blood concentrations of gluconeogenic substrates and hormones. During basal periods (steady state, short term fasting) gluconeogenesis in the liver is the primary process involved in supplying glucose to the blood and controlling the blood glucose concentration. During periods of high blood glucose concentration, the glucose outputs from both glycogenolysis and gluconeogenesis are reduced and the primary function of the liver is to convert blood glucose to glycogen to be stored in the liver for later use in the process of glycogenolysis.

The liver model for the 17.5 kg canine involves developing mathematical models (transfer function) for the following liver function:

1. Conversion of glucose to glycogen
2. Conversion of glycogen to glucose (glycogenolysis)
3. Conversion of amino acids to glucose (gluconeogenesis)
4. Conversion of lactate to glucose (gluconeogenesis)

5. Conversion of glycerol to glucose (gluconeogenesis)

These mathematical models describe the rates of liver glucose output and input in terms of the blood concentrations of glucose, gluconeogenic substrates, the hormones insulin and glucagon, and the quantity of glycogen stored in the liver.

The approach taken to develop the mathematical models was to determine which of the above factors were primarily responsible for the control of the rate of liver glucose output and input, and then to describe the basal, maximum, and minimum liver glucose output and input rates as a continuous function of these factors. These continuous functions have been derived directly from applicable data, from extrapolation of comparable data, or intuitively from general physical phenomena. The dependent-independent relationship of the liver mathematical models are in terms of first order effects only, since this is the form of most of the data and to describe a mathematical model of the liver otherwise, would be extremely time-consuming and awkward, if not impossible. Following is a detailed explanation for the derivation of the mathematical models of each of the above-mentioned five liver functions.

Conversion of Glucose to Glycogen

The data used to develop the mathematical model for the conversion of glucose to glycogen is principally contained in references (3, 6, 18, 49). From this data, it has been determined that the rate at which glucose is converted to glycogen in the liver is a function of

the blood glucose, insulin, and glucocorticoids concentrations perfusing the liver and also the quantity of glycogen that is stored in the liver.

$$SEW3L = (K1)\ f_1\ (GC1L)\ f_2\ (IC1L)\ f_3\ (EW3L)$$

where

SEW3L - is the rate at which glucose is converted to glycogen, (mg/min)

K1 - the maximum rate at which glucose can be converted to glycogen, (mg/min)

GC1L - the glucose concentration in the blood plasma of the liver, (mg/ml)

IC1L - the insulin concentration in the blood plasma of the liver, (ng/ml)

EW3L - the quantity of glycogen that is stored in the intracellular fluid of the liver, (gm).

The glucocorticoid function has not been included because of a lack of data, the overall complexity of the function, and the time delay (approximately two hours) before glucocorticoids are effective.

The mathematical model that has been derived is:

$$SEW3L = (137.5)(GC1L/4)(1 - e^{-IC1L/2.0}) \times \left[1 - \frac{EW3L/550}{(0.029)(1.5 - 0.5e^{-IC1L/1.56})(\sqrt{GC1L})}\right]. \quad (4)$$

The K1 term has been derived from the data of (6) and (18). The

data of (6) indicates a half maximum rate of 0.5%/hr of liver weight for the conversion of glucose to glycogen at a glucose concentration of 2.0 mg/ml. The data of (18) reports a 1.1%/hr of liver weight conversion at a glucose concentration of 2.5 mg/ml. If it is assumed that the conversion of glucose to glycogen varies linearly as a function of glucose concentration and that this function saturates at a glucose concentration of 4.0 mg/ml, then averaging the maximum rates of (6) and (18) yields a rate of approximately 1.5%/hr of liver weight at a glucose concentration of 4.0 mg/ml. For the 550 gm liver of a 17.5 kg canine, this equates to a maximum conversion rate of glucose to glycogen of 8.25 gm/hr or 137.5 mg/min.

The insulin function

$$(1.0 - e^{-ICIL/2.0}) \qquad (5)$$

has been determined from the data of (3). This data gives a near maximum conversion of glucose to glycogen of 495 umoles/hr/30 gm of liver, at a glucose concentration of 1.0 mg/ml and an insulin infusion rate of 0.04 - 0.2 units/kg/hr. This level of insulin infusion results in a near maximum physiological insulin concentration in the blood. The rate of 495 umoles/hr/30 gm of liver converts to 1.63 gm/hr for the 550 gm liver of a 17.5 kg canine. Also the data of (3) for the pancreatectomized dog indicates there is no conversion of glucose to glycogen when insulin is not present. The insulin function produces (SEW3L) equal to (0.0, 34.3 mg/min) for no and maximum insulin, respectively, and basal glucose. The insulin function (5) produces a 3 : 1 increase in the conversion of glucose to glycogen

when the maximum insulin effect is compared to that of the basal insulin concentration (IC1L) of 0.78 ng/ml.

The glycogen storage function

$$1 - \frac{EW3L/550}{(0.029)(1.5 - 0.5\, e^{\,-IC1L/1.56})\sqrt{GC1L}} \qquad (6)$$

has been derived from the data of Mortimore (49) (see Figure 12) and has been incorporated into the mathematical model to account for the dependence of the liver's glycogen storage capacity upon the liver's blood plasma concentrations of both glucose and insulin. This function is designed to allow glucose to be converted to glycogen whenever the maximum storage capability of the liver has not been attained for the instantaneous glucose and insulin concentrations of the liver's

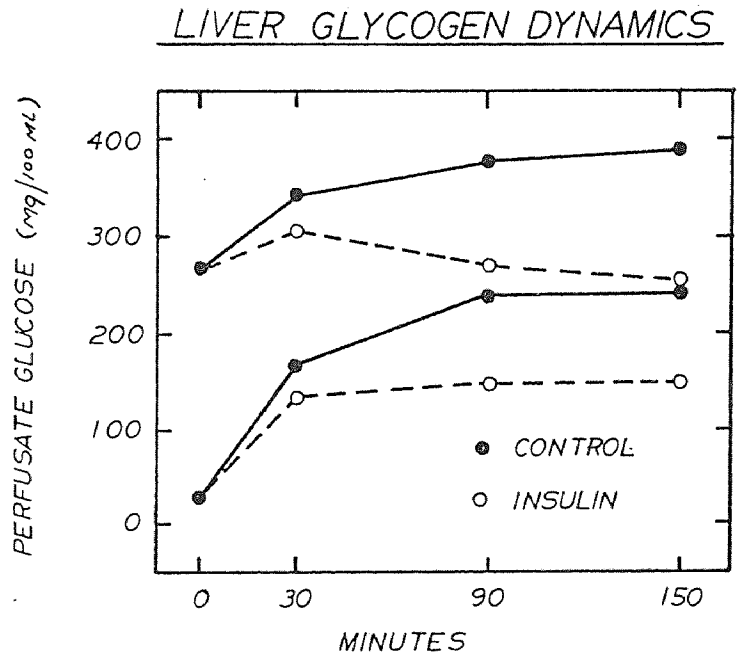

FIGURE 12*

*From Mortimore (12).

blood plasma. Although this function controls the rate of glucose to glycogen conversion almost in proportion to the difference between the amount of glycogen the liver is capable of storing and the actual amount of glycogen that is stored in the liver, this function has not been designed to simulate actual rate data simply because this data is not available in a form convenient to model. (See Conversion of Glycogen to Glucose for a partial justification for this derivation.)

The ability of the liver to store glycogen as a function of insulin concentration is based on a 2200 gm human liver being able to store 75 gm (3.5% of liver weight) of glycogen, (8) and (49). From the data of (49) (see Figure 12), it was possible to determine the glycogen content of the liver with no insulin (28 mg/gm) and the glycogen content of the liver (42 mg/gm) with the maximum effective physiological concentration of insulin, both glycogen storages being at a glucose concentration of approximately 2.4 mg/ml. The increase in glycogen storage capability is approximately fifty per cent from no insulin to the maximum effective physiological concentration of insulin. Assuming the insulin storage function to be approximately exponential and the minimum, basal, and maximum storage capability to be 2.9, 3.5, 4.4% of liver weight, respectively, the insulin storage function becomes

$$(0.029)\ (1.5 - 0.5e^{-ICIL/1.56}). \qquad (7)$$

The glucose concentration storage function is also derived from the data of (49) (see Figure 12). For both no insulin and maximum

effective insulin a sixty per cent increase in the glucose concentration (GC1L) resulted in approximately a twenty-two per cent increase in the maximum glycogen storage capability of the liver, so that the glucose concentration storage function becomes

$$\sqrt{GC1L} \tag{8}$$

and the combined insulin-glucose concentration storage function becomes

$$(0.029)\ (1.5 - 0.5e^{-IC1L/1.56})\ \sqrt{GC1L}\ . \tag{9}$$

The actual glycogen storage fraction is

$$EW3L/550 \tag{10}$$

By subtracting the ratio of the actual glycogen storage fraction to insulin-glucose concentration storage function from 1.0, a measure of the difference between the glycogen storage capability of the liver and the actual glycogen stored in the liver is obtained.

$$1.0 - \frac{EW3L/550}{(0.029)\ (1.5 - 0.5e^{-IC1L/1.56})\ \sqrt{GC1L}}\ . \tag{11}$$

This function is very nearly proportional to the difference between the glycogen storage capability and the actual glycogen stored.

The computer program describes (SEW3L) in terms of two additional variables (GLYSTO and GLUGLY). These two variables have been introduced as part of a limit function so that the storage function, and likewise (SEW3L), never becomes negative.

Conversion of Glycogen to Glucose

Glycogen is capable of being converted back to glucose at a maximum rate of approximately 10 gm/hr (167 mg/min), (22, 63) by the process of glycogenolysis. From the data of (22, 49, 63), the conversion rate of glycogen to glucose is a function of the quantity of glycogen stored in the liver and the blood concentrations of insulin, glucagon, and glucose perfusing the liver.

$$GR22L1 = (K2)\ f_1\ (EW3L)\ f_2\ (AC1L)\ f_3\ (GC1L,\ IC1L)$$

where:

GR22L1 - the rate at which glycogen is converted to glucose in the liver (mg/min)

K2 - the maximum rate at which glycogen is converted to glucose (mg/min)

AC1L - the glucagon concentration in the blood plasma of the liver (ng/ml)

IC1L, EW3L- the same as defined under (Conversion of Glucose to Glycogen.)

Glucocorticoids also affect the rate at which glycogen is converted to glucose, but this function has not been included for the same reasons previously given.

The mathematical model that has been developed for the conversion of glycogen to glucose is:

$$GR22L1 = 167.0\,(1 - e^{-EW3L/4.5})(1 - e^{-AC1L/0.20}) \times \left[1 - \frac{(GC1L)(3.0 - 2.1e^{-IC1L/0.78})100}{(0.9)(0.65 \times EW3L)^{2.4}}\right] \quad (12)$$

The maximum conversion rate of 167 mg/min from glycogen to glucose has been verified from the data of (22). This data gives the hourly maximum rates of glucose production (gluconeogenesis) from the livers of fasted rats as a function of the glucagon concentration of the perfusing blood plasma, and also similar data but for the livers of fed rats. By taking the difference between these two sets of data, the glucose produced from glycogen (glycogenolysis) is obtained. The maximum rate of glucose production from glycogen is 105 umoles/gm-liver/hr. For the glucose molar weight of 180 gm and a 550 gm canine liver, this rate becomes 10.4 gm/hr (173 mg/min).

By plotting the above difference data, it is possible to determine the rate at which glucose is produced from glycogen as a function of glucagon. Although the glucagon concentrations required to produce glucose are higher by nearly a factor of three than the average physiological glucagon concentrations, by considering the fact that the liver rapidly degrades glucagon (2, 64) it is possible to justify using this data to model the glucagon function. Assuming that the basal glucagon concentration (0.09 ng/ml) in the liver blood plasma is capable of producing glucose at one-third its maximum rate, then the mathematical model for the glucagon function becomes:

$$(1 - e^{-ACIL/0.20}). \tag{13}$$

The mathematical model for the glycogen storage factor:

$$(1 - e^{-EW3L/4.5}) \tag{14}$$

has been derived from the data of (63). When glucagon was added to the liver perfusion system to produce near maximum glycogenolysis from a rat liver that had a glycogen storage of ten per cent of maximum, glucose was produced at a rate that was thirty per cent of the maximum conversion rate of glycogen to glucose.

The insulin and glucose term

$$1 - \frac{(GCIL)(3.0 - 2.1^{-ICIL/0.78})(100)}{(0.9)(0.65 \times EW3L)^{2.4}} \tag{15}$$

is the complement of the last term (11) derived for the mathematical model for the conversion of glucose to glycogen. This term has been included to cause glycogen to be converted to glucose to maintain the dynamic equilibrium that exists between glycogen storage (EW3L), insulin concentration (ICIL), and glucose concentration (GCIL), as reflected in the data of (49), (see Figure 12). The basis for the derivation of this term is the fact that glycogen is converted to glucose at a rate that is approximately proportional to the difference between the starting glucose concentration level and the equilibrium glucose concentration level when both the initial glycogen storage (EW3L) and insulin concentration (ICIL) levels are equal. For

the control data, the initial rate at which glycogen is converted to glucose for low and high glucose concentration levels is 98 and 42 mg/hr/liver, respectively. The difference between the starting glucose concentration level and the equilibrium glucose concentration level for low and high glucose concentration levels is 200 and 110 mg/100 ml, respectively. On this basis, the mathematical model for this term is derived form the ratio of the difference between the equilibrium and actual glucose concentration levels and the equilibrium glucose concentration level.

$$\frac{\text{Equil. Gluc. Conc. -- Act. Glu. Conc.}}{\text{Equil. Gluc. Conc.}}$$

The equilibrium glucose concentration term is:

$$\frac{(0.9)(0.65 \times EW3L)^{2.4}}{(100)(3.0 - 2.1e^{-ICIL/0.78})}. \qquad (16)$$

The term is a composite of a glycogen storage term:

$$(0.65 \times EW3L)^{2.4} \qquad (17)$$

and an insulin term:

$$\frac{(0.9)}{(3.0 - 2.1e^{-ICIL/0.78})(100)}. \qquad (18)$$

The glycogen term (17) has been derived from the low and high glucose concentration control data points at 150 minutes, (see Figure 12). The respective glycogen levels are 27.9 and 32.2 mg/gm (13.2, 15.7 gm

for 550 gm canine liver) resulting in glucose concentration levels of 230 and 380 mg/100 ml.

For the insulin data at 150 minutes, a factor of three is required to adjust the glycogen term resulting in the insulin term (18).

When the equilibrium glucose concentration term is substituted into the ratio term, the resulting insulin and glucose term becomes:

$$1 - \frac{(GC1L)(3.0 - 2.1e^{-IC1L/0.78})(100)}{(0.65 \times EW3L)^{2.4} \times (0.9)} \quad (19)$$

The computer program contains two additional terms (Factor and GLGL) which have been included to limit GR22L1 to only positive values.

Conversion of Amino Acids to Glucose

The conversion of amino acids to glucose in the liver is primarily a function of the liver blood plasma concentration of amino acids, (43). The blood plasma concentrations of amino acids are a function of the concentrations of both insulin and glucagon, (10, 56).

From the data of (43), a mathematical model has been developed describing the rate at which glucose is produced from amino acids as a function of the normalized basal amino acid concentration.

$$GR22L2 = 131\ (1 - e^{-(AAN)^3/10}) \quad (20)$$

Where GR22L2, the rate at which glucose is produced from amino acids,

is made to equal the basal glucose production rate of 13.1 mg/min at a normalized basal amino acid concentration (AAN) of 1.0, and 122 mg/min for a normalized amino acid concentration of 3.0.

The regulation of the normalized basal liver blood plasma amino acid concentration is by way of the body muscle blood plasma concentrations of insulin (ICIM) and glucagon (ACIM). The data of Chiasson (10), shows a near twofold increase in the rate at which the amino acid alanine is converted to glucose when glucagon is administered at near maximum physiological levels. Although Chiasson could not preclude that this doubling rate was not due to an increase in the liver blood plasma amino acid concentration, the data of (43) and the result of other workers has shown that with fixed amino acid concentration levels, glucagon has increased gluconeogenesis minimally. It is thus concluded that glucagon regulates the liver blood plasma amino acid concentrations. The mathematical model for the normalized amino acid glucagon function becomes:

$$3\,(1 - e^{-ACIM/0.07}). \tag{21}$$

The data of (56) demonstrates that high physiological levels of insulin are capable of reducing the amino acid concentration in the venous forearm blood plasma by a factor of two. The mathematical model for the insulin function of the normalized amino acid concentration becomes:

$$(0.5)(1 + e^{-(LC1M/1.0)^2}). \qquad (22)$$

Combining both the glucagon and the insulin functions, (21, 22) the mathematical model for the normalized amino acid concentration becomes:

$$AAN = (1.5)(1 - e^{-(AC1M/0.07)})(1 + e^{-(IC1M/1.0)^2}). \qquad (23)$$

Conversion of Lactate to Glucose

Lactate is converted to glucose in the liver of a 17.5 kg canine, under basal conditions, at a rate of 0.4 gm/hr (6.67 mg/min), extrapolated from the data of (8). The maximum conversion rate appears to be approximately ten times this rate under the conditions of high lactate concentrations (22). In vivo high lactate concentrations would be produced when glycogen stored in body muscle is converted by glycogenolysis to lactate under the influence of adrenaline. Because glucose produced from lactate is only a small part of the total glucose production, the lactate-adrenaline function has not been included. The more direct action of both glucagon and insulin on the liver production of glucose from lactate (21, 22, 49, 54) have been included in the mathematical model for the conversion of lactate to glucose.

From the data of (21), glucagon has caused a three to one increase in the production of glucose from lactate. Although this data was with saturating lactate concentration, the data of (21)

corroborates a three to one variation capability in glucose production from basal to saturating levels of lactate. The mathematical model for the glucagon function becomes:

$$6.67 \left[0.5 + 2.5 \left(1 - e^{-(ACIL/0.4)}\right)\right] . \qquad (24)$$

The data of (49, 54) indicate that there is approximately thirty per cent reduction in the rate at which glucose is produced from lactate from no insulin to a basal insulin concentration. The mathematical model for the insulin function becomes:

$$\left(1 + 0.5e^{-ICIL/0.78}\right) \qquad (25)$$

and the overall mathematical model for the conversion of lactate to glucose becomes:

$$GR22L3 = 6.67 \left[0.5 + 2.5 \left(1 - e^{-ACIL/0.4}\right)\right] x \left(1 + 0.5e^{-ICIL/0.78}\right) \qquad (26)$$

SECTION V

DEVELOPMENT OF PANCREAS MODEL

The pancreas of a 17.5 kg canine weighs approximately 58 grams, has a blood flow through it of approximately 46 ml/min, and secretes both insulin and glucagon in response to the glucose concentration of the blood plasma perfusing it. An increase in the blood plasma glucose concentration will cause a corresponding increase in the secretion of insulin and a decrease in the secretion of glucagon. A mathematical model for the pancreas has been developed using the data of (32, 40, 45), (see Figure 13).

The mathematical model for insulin is:

$$IR = (526)\ (GClP) - 384 \tag{27}$$

where:

IR - is the rate at which insulin is secreted by the canine pancreas (ng/min)

GClP - is the blood plasma glucose concentration of the pancreas (mg/ml).

This equation for the insulin output is a straight line approximation of the data of (32), (see Figure 13). This equation when limited by the CSMP computer program function LIR will cause no insulin to be secreted from the pancreas for blood plasma glucose concentrations below 0.73 mg/ml, and a maximum insulin secretion of 1300 ng/min for blood plasma glucose concentration above 3.2 mg/ml.

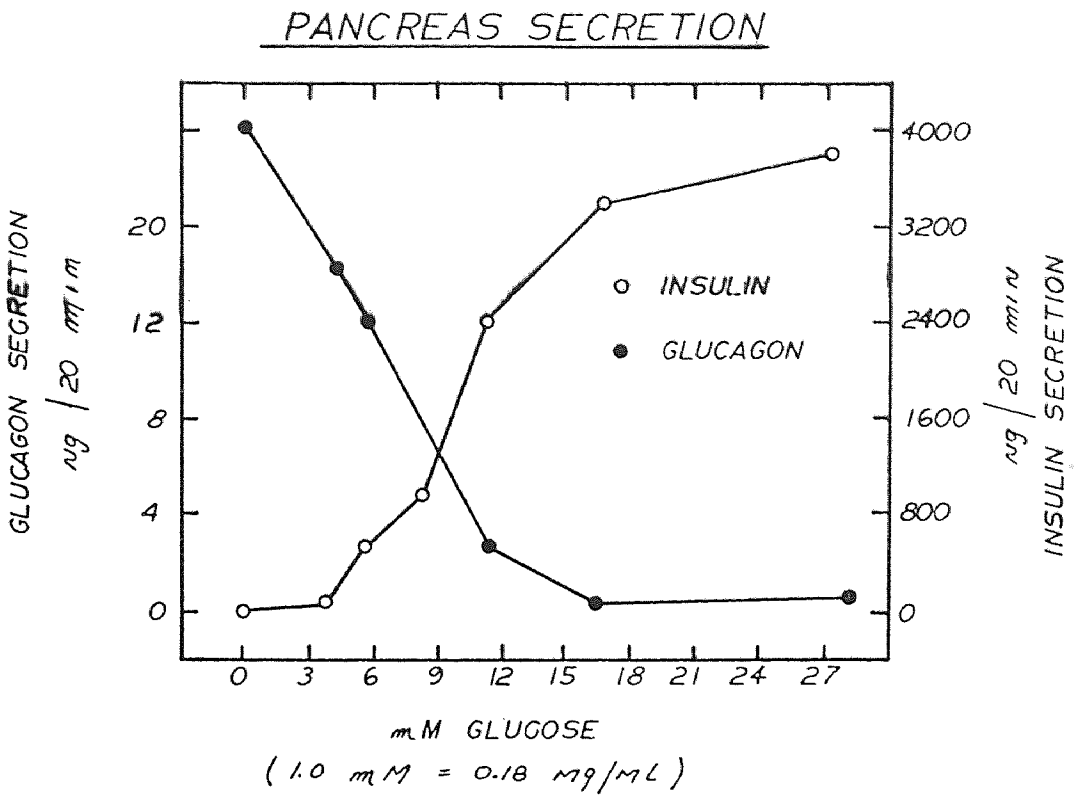

FIGURE 13*

The insulin data of Figure 13 appears to be in error by a factor of ten, since it is in conflict with latter data of (32). The data of Figure 13 when extrapolated for a 17.5 kg canine on the basis of body weight would produce a maximum insulin secretion rate of 14000 ng/min. The insulin secretion rate is much too high for the overall body insulin admittance and would cause extremely high basal blood plasma insulin concentrations. The later data of (32) correlates with the data of (45) and would produce the basal blood plasma insulin concentration of 0.5 ng/ml for the calculated overall body insulin admittance. For this reason, the insulin data of Figure 13 has been scaled down by a factor of ten.

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*From Gerich (32).

The mathematical model for the pancreas glucagon function is:

$$AR = 60 \left[1 - 0.72\ (GC1P) \right] \tag{28}$$

where:

AR - is the rate at which glucagon is secreted from the canine pancreas (ng/min)

GC1P - is the blood plasma glucose concentration of the pancreas (mg/ml).

This equation is also a straight line approximation of the data from Figure 13. The maximum glucagon secretion is 60 ng/min when extrapolated for a 17.5 kg canine. No glucagon is secreted for blood plasma concentration above 1.4 mg/ml. This low limit of zero is produced by the LAR limit function of the CSMP computer program. The basal glucagon secretion is 16.8 ng/min and will cause a basal blood plasma glucagon concentration of 0.06 ng/ml.

SECTION VI

DEVELOPMENT OF MUSCLE MODEL

Body muscle accounts for approximately forty per cent of the total body weight. During periods of high blood plasma glucose concentration, body muscle converts glucose to glycogen in the intracellular fluid where the glycogen is stored. During periods of low blood plasma glucose concentration, the muscle glycogen is converted to lactate and returned to the blood plasma to be converted to glucose by the liver.

The rate at which glucose is converted to glycogen in the intracellular fluid of the body muscle is a function of the insulin concentration of the body muscle blood plasma. Insulin varies the glucose admittance (GK23M) of the cell membrane separating the body muscle's interstitial fluid (V2M) from its intracellular fluid (V3M) by what is known as an active transport system. The mathematical model derived for the glucose admittance between the interstitial and intracellular fluids is:

$$GK23M = \frac{(V1 + V2)(IC2M \times 1.27)^{2.5}}{1000} \qquad (29)$$

where:

GK23M - is the glucose admittance of the cell membrane (mg/min/mg/ml)

V1, V2- are the total body blood plasma and interstitial fluid volumes, respectively (ml)

IC2M - is the insulin concentration of the body muscle interstitial fluid (ng/ml).

The equation for (GK23M) has been derived from the data of R. C. de Bodo, M.D., et al (16), (see Figures 14 and 15). The in vivo canine data of (16) relates the blood plasma glucose concentration, the outflow of glucose to the tissue, and the inflow of glucose from the liver, for different rates of insulin infusion into the blood of the canine. By assuming that the basal inflow of glucose (145 mg/kg/hr, 3.8 gm/m^2/hr) from the liver is entirely taken up by the central nervous system (CNS) and that this CNS glucose requirement remains constant, independent of the blood plasma glucose concentration, it is possible to calculate both the glucose disappearance ratio (k, %/min), due to muscle glucose absorption, and the average blood plasma insulin concentration (ng/ml) for three different sets of conditions.

From the data of (16), it is possible to determine the rate at which glucose is being absorbed by the muscle and also the average glucose concentration over the time period of interest. It is also possible to calculate the insulin concentration using input flow rates of insulin and the overall body admittance of 285 (ng/min)/(ng/ml). From t = 0 to t = 26 min of Figure 14, the average insulin concentration was calculated to be 9.46 ng/ml while the glucose disappearance ratio was 4.6%/min. Over the time interval t = 40 to t = 140 min of Figure 14, the insulin concentration was calculated to be 6.8 ng/ml and the glucose disappearance ratio 2.1%/min. From Figure 15, for the time interval from t = 0 to t = 95 min, the insulin concentration was calculated to be 2.74 ng/ml and the glucose disappearance ratio 0.55%/min.

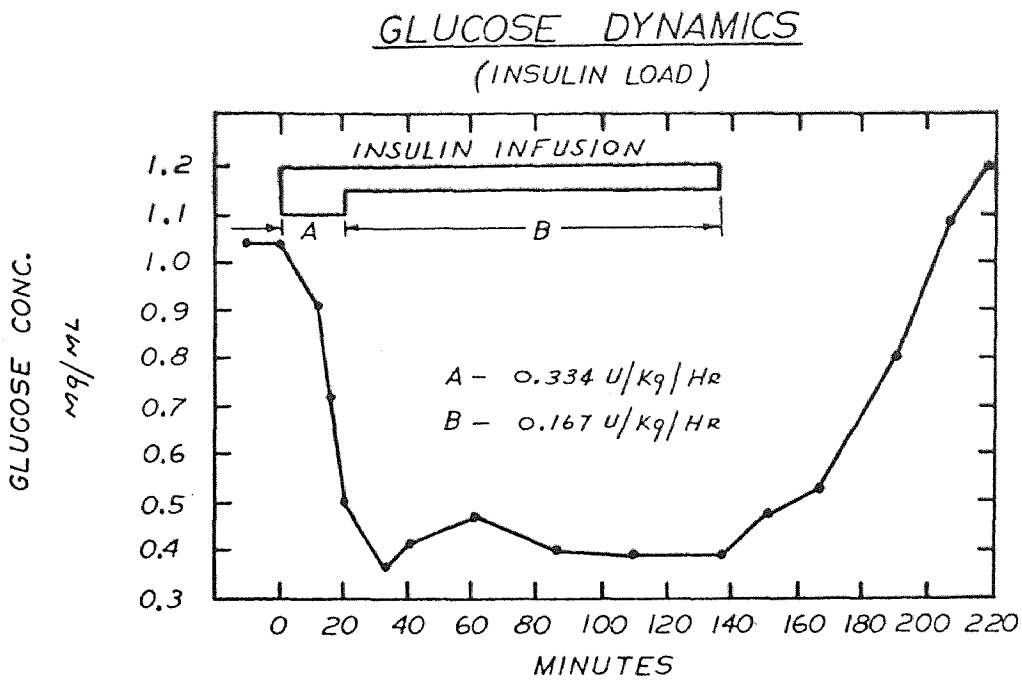


FIGURE 14*

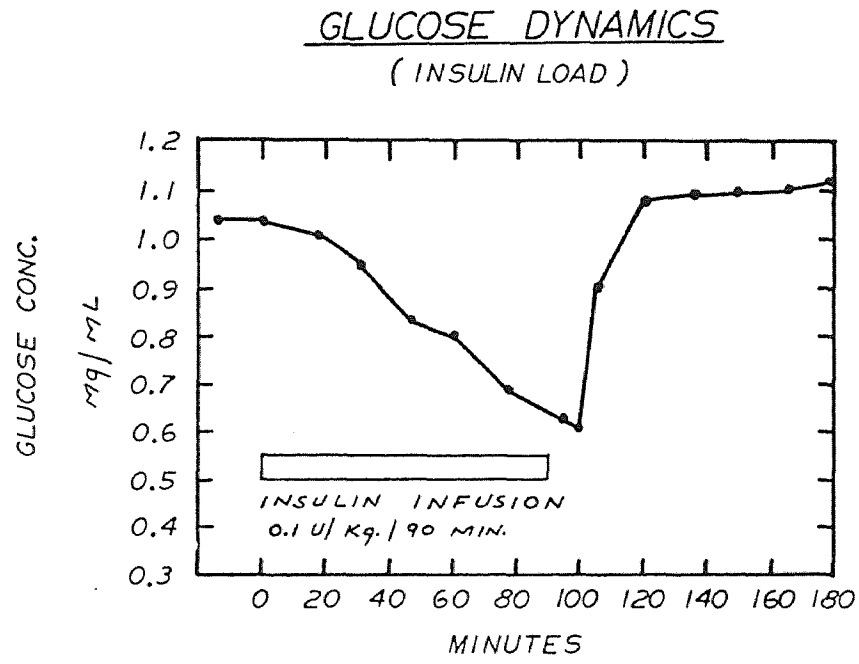


FIGURE 15*

*In Vivo Test Data, de Bodo (16).

By plotting the near square law relationship between the glucose disappearance ratio (k, %/min) and the insulin concentration (ng/ml), and then using trial and error, it is possible to derive an equation which describes the glucose disappearance ratio (k, %/min) as a function of the insulin concentration (ng/ml).

$$k = \frac{(\text{Insulin Conc.} \times 0.533)^{2.5}}{10} \tag{30}$$

To convert the glucose disappearance ratio (k, %/min) to glucose admittance (GK23M) in terms of the insulin concentration (IC2M) of the body muscle blood plasma, it is necessary to multiply the scaling factor (0.533) by (2.38) and (k) by (V1 + V2)/100. The (2.38) factor is required because the insulin concentration was calculated as average overall body value while the insulin concentration (IC2M) of the body muscle interstitial fluid compartment (V2M) is approximately one-half of the calculated average value. The factor (V1 + V2)/100 is required because the disappearance ratio (k) was calculated as a (%/min) of the total glucose contained in the overall body blood plasma and interstitial fluid V1 and V2.

$$k = \frac{(\text{Glucose loss to muscle})/\text{min}}{(\text{Glucose in V1 and V2})} \times 100$$

or

$$(\text{Glucose loss to muscle})/\text{min} = \text{SEW3M} = \frac{(k)(\text{Glucose in V1 and V2})}{100}$$

where

$$(\text{Glucose in V1 and V2}) = (V1 + V2)(\text{Glucose Conc.}).$$

Then

$$SEW3M = \frac{(k)(V1 + V2)\ (Glucose\ Conc.)}{100} . \qquad (31)$$

The term:

$$\frac{(k)(V1 + V2)}{100}$$

represents the glucose admittance (GK23M) between the interstitial and intracellular fluid of body muscle when the average body glucose concentration is approximately equal to the glucose concentration (GC2M) of the interstitial fluid of the body muscle, and is substituted for (Glucose Conc.) in equation (31) for (SEW3M). The mathematical model for the rate at which glucose is converted to glycogen (SEW3M) in the intracellular fluid (V3M) of the body muscle becomes:

$$SEW3M = (GK23M)(GC2M)$$

$$SEW3M = \frac{(V1 + V2)}{(100)} \times \frac{(IC2M \times 1.27)^{2.5}\ (GC2M)}{(10)}$$

The conversion of body muscle glycogen to lactate involves the adrenal hormones adrenaline and glucocorticoids. This process is relatively slow compared to action of both insulin and glucagon in the regulation of the glucose concentration and for this reason will not be modeled.

SECTION VII

DEVELOPMENT OF COMPUTER MODEL

The development of the computer model to describe the Dynamics of the Glucose-Insulin-Glucagon System involves developing equations to define all of the pertinent variables for each of the major body components in terms of the particular body component's physical characteristics and its inputs from the other major body components. The resulting set of equations integrates all of the major body components into the mathematical model.

In developing these equations, it was necessary to use mneumonic terms for the many constants and variables that were both, compatible with the Continuous Systems Modeling Program (CSMP) for the 360 Digital Computer, and would also have logical meaning so that anyone of the many equations could be read without resorting to a glossary for each term.

Development of Mneumonics

The Continuous System Modeling Program (CSMP) requires that all terms describing either constants or variables be defined by a string of not more than six alpha-numeric characters and that the first character be alphabetic. To meet this requirement and to also assign meaning to the many constants and variables, a format was developed which assigned meaning to each of the alpha-numeric characters and its location in the six character alpha-numeric string, (see Table II and Figure 16). Those terms that do not conform to the format of

MNEUMONIC DESCRIPTION

(1)	(2)	(3)	(4) (5)	(6)	(7)
S - First Derivative Blank	I - Insulin (ng) G - Glucose (mg) E - Glycogen (mg) A - Glucagon (ng) B - Blood (ml) P - Plasma (ml) Blank	C - Concentration ( )/ml K - Transport Constant (( )/min)/(( )/ml) R - Rate of flow (ml/min) V - Volume (ml) W - Weight (mg)	11 - Input 22 - Output 12 - 1 → 2 21 - 2 ← 1 23 - 2 → 3 32 - 3 ← 2 1 - Plasma 2 - Interstitial 3 - Intracellular	A - Front Paws C - Head F - Heart (Right Side) S - Heart (Left Side) I - Alimentary Tract K - Kidney L - Liver P - Pancreas R - Lung W - Hind Legs M - Muscle	I - Initial Blank

TABLE II

MNEUMONIC LABELING

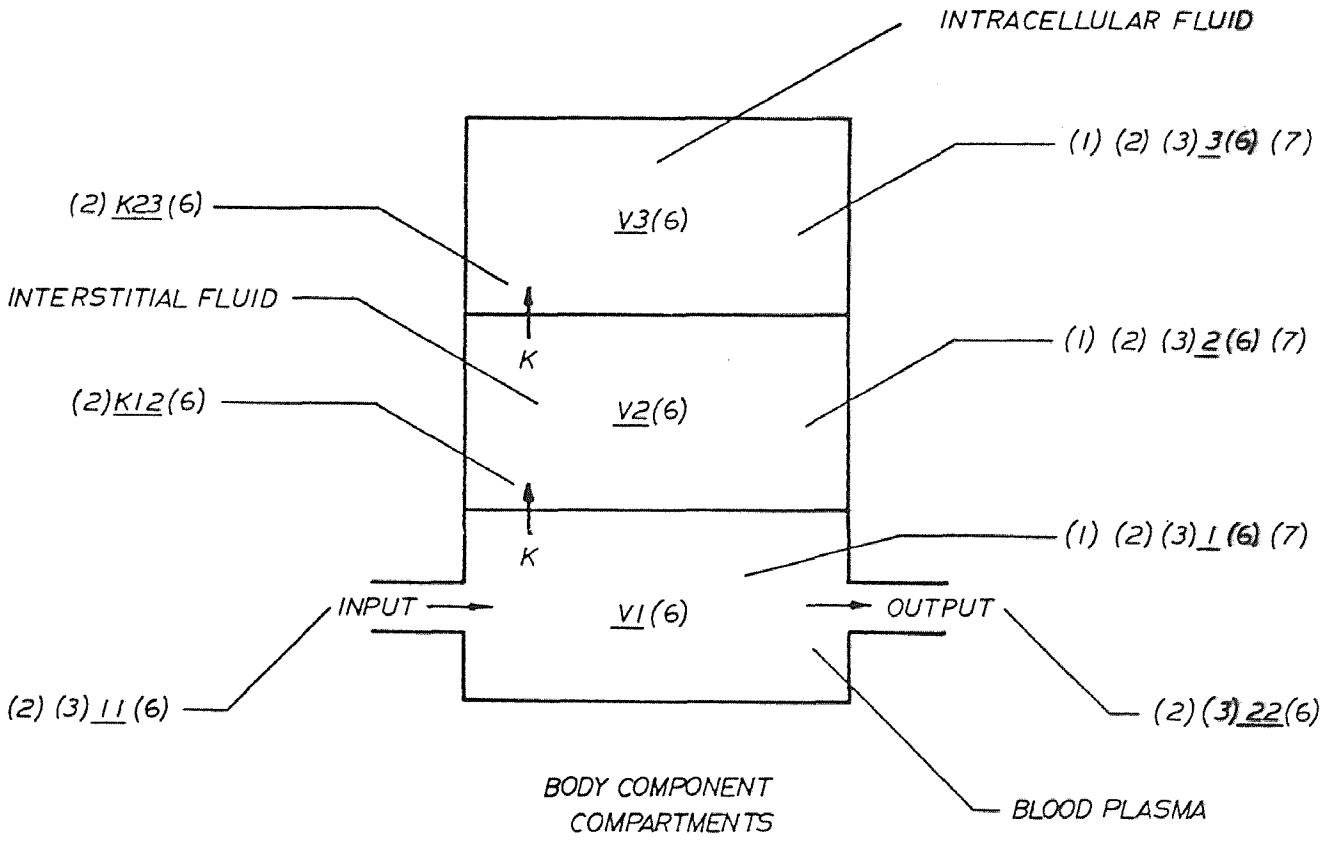


FIGURE 16

Table II are listed and defined in Table III. A brief explanation of the significance of each of the six character positions of the alpha-numeric terms follows:

Character Position (1) - Alpha -

The first character position will contain either the letter "S" or a blank (no letter at all). The letter "S" signifies that the term is a first derivative. A blank signifies a non-derivative term in which case one of the possible characters of position (2) will be the first character of the term.

Character Position (2) - Alpha -

Character Position (2) defines the substance that is being labeled by the term. An example would be "A" for glucagon (ng) or "G" for glucose (mg).

Character Position (3) - Alpha -

Character Position (3) assigns the type of dimension which is applicable to the term. An example would be "C" for concentration, where the glucagon concentration would be measured in (ng/ml) while the glucose concentration would be (mg/ml).

Character Position (4, 5) - Numeric -

Character Position (4, 5) is used to define a location in the major body component being modeled or

the place and direction of transport. A single numeric "1, 2, or 3" defines the plasma, the interstitial, or the intracellular fluids, respectively. The double numeric "11" specifies the input, while the "22" specifies the output. All other double numerics are used to define the place and direction of an admittance. The numeric "12" would specify an admittance going from the blood plasma into the interstitial fluid compartment. The dimensions of admittance would be the dimensions of Character Position (2) per unit of concentration per minute. For insulin this would be (ng/min)/(ng/ml)

Character Position (6) - Alpha -

This character position indicates the major body component to which the term applies.

Character Position (7) - Alpha -

Character Position (7) will contain either the letter "I" or be blank (no letter at all). The letter "I" is used to indicate an initial condition. The absence of the letter "I" would make one of the Character Position (5) characters the last character of the term.

Since no (CSMP) term can contain more than six alpha-numeric

characters, it is obvious that either the first and/or the seventh character positions must be blanks. The minimum number of alpha-numeric characters making up a formated (CSMP) term is three. This is the case when describing the blood plasma, interstitial, or intra-cellular fluid volumes for any of the major body components. The (CSMP) term for the interstitial fluid of the head would be (V2C).

Development of Equations

To better understand how the equations which make up the mathematical model for the Glucose-Insulin-Glucagon System have been developed, the nine equations:

```
SGW1C = ((GC1S)*(BR11C) - (GC1C)*(BR22C))*(HK) - (GC1C
   - GC2C)*(GK12C)
GW1C = INTGRL(0.0, SGW1C)
GC1C = GC1CI + GW1C/V1C

SGW2C = (GC1C - GC2C)*(GK12C) - (GC2C - GC3C)*(GK23C)
GW2C = INTGRL(0.0, SGW2C)
GC2C = GC2CI + GW2C/V2C

SGW3C = (GC2C - GC3C)*(GK23C) - 23.0
GW3C = INTGRL(0.0, SGW3C)
GC3C = GC3CI + GW3C/V3C
```

which describe the flow of glucose into, out of, and through the fluid compartments of the head will be detailed. These nine equations are divided into three groups with each group of three equations describing the glucose dynamics for the blood plasma compartment, the interstitial fluid compartment, and the intracellular fluid compartments of the head, respectively.

The necessary constants are:

Volume:

V1C = 23.0 ml
V2C = 74.0 ml
V3C = 204.0 ml

Blood Flow Rate:

BR11C = 322.0 ml/min
BR22C = 322.0 ml/min

Glucose Admittance:

GK12C = 76.6 (mg/min)/(mg/ml)
GK23C = 38.3 (mg/min)/(mg/ml)

Initial Conditions:

GC1CI = 1.0 mg/ml
GC2CI = 1.0 mg/ml
GC3CI = 1.0 mg/ml

Plasma Ratio:

HK = 0.727

The first group of three equations describes the glucose dynamics in the blood plasma compartment (V1C) of the head (C). The first equation in this group defines the rate (SGW1C) at which the weight (W) of glucose is changing in the blood plasma compartment (V1C).

```
SGW1C = ((GC1S)*(BR11C) - (GC1C)*(BR22C))*(HK)
   -(GC1C - GC2C)*(GK12C)
```

The first factored term of this equation describes the transport of glucose into and out of the head by the blood flow. The term (GC1S) is the glucose concentration of the blood plasma compartment (V1S) for the heart, and is used to define the glucose concentration

of the blood entering the head. The plasma ratio (HK) is required because the glucose concentration is defined as mg of glucose per ml of plasma, while the blood flow into the head is for whole blood. The second term of this equation describes the transport of glucose, by perfusion, between the blood plasma and interstitial fluid compartments of the head in terms of the glucose concentration in each of these compartments (GC1C, GC2C) and the glucose admittance between the compartments (GK12C). The admittance is assumed to be bidirectional with (GK12C = GK21C).

The second equation of the first group:

GW1C = INTGRL (0.0, SGW1C)

is a (CSMP) function block used to integrate the first equation (SGW1C) to obtain the change of glucose weight (GW2C) in the blood plasma compartment from time t = 0. The (0.0) term of this equation sets the initial value of (GW1C) equal to (0.0).

The third equation of the first group:

GC1C = GC1CI + GW1C/V1C

describes the glucose concentration (GC1C) in the blood plasma compartment (V1C) of the head in terms of the initial glucose concentration (GC1CI), the change of glucose weight (GW1C), and the blood plasma volume (V1C) of the head.

The second group of three equations describes the glucose dynamics in the interstitial fluid compartments (V2C) of the head. The first of these three equations:

```
SGW2C = (GC1C - GC2C)*(GK12C)
 -(GC2C - GC3C)*(GK23C)
```

defines the rate (SGW2C) at which the weight of glucose in this compartment is changing. The first factored term of this equation describes the transport of glucose between the blood plasma and interstitial fluid compartments in terms of the glucose concentrations (GC1C, GC2C) in, and the glucose admittance between these compartments. Similarly, the second factored term of this equation describes the transport of glucose between the interstitial fluid compartment (V2C) and the intracellular fluid compartment (V3C).

The second and third equations of the second group:

```
GW2C = INTGRL(0.0, SGW2C)
GC2C = GC2CI + GW2C/V2C
```

are similar to the second and third equations of the first group, defining the weight change of glucose (GW2C) and the glucose concentration (GC2C) in the interstitial fluid compartment (V2C) of the head.

The third group of three equations describes the glucose dynamics in the intracellular fluid compartment (V3C) of the head. This group is similar to the second group of equations with the exception of the (23.0) term. This term represents the glucose load of (23.0) mg/min that is supplied to the brain to meet its glucose requirements.

Similar equations have been written to define the dynamics of both insulin and glucagon in the three fluid compartments (V1C, V2C, V3C) of the head, and likewise for the other major body components.

SECTION VIII

RESULTS

The CSMP program to model the dynamics of the Glucose-Insulin Glucagon System is listed in Figures 17a through 17e. The first part of the program lists the constant and initial condition terms, followed by the equations describing the dynamics for each of the major body components. The last part of the program describes the integration method, the time parameters, and the desired outputs and the form for these outputs.

The CSMP model for the Dynamics of the Glucose-Insulin-Glucagon System was then exercised to determine its response for the following three conditions:

1. Basal
2. Glucose Load
3. Insulin Load

Basal condition data was run for a period of 150 minutes first with all initial conditions very nearly at basal level values (see Figures 18a through 18f). To demonstrate the dynamic equilibrium of the liver glycogen storage (EW3L), similar basal data was run but with three different levels of initial glycogen stored in the liver (EW3LI = 0.0, 10.0, and 19.25 gm), (see Figures 19a through 19c).

The model was then exercised with an almost instantaneous 8.5 gm glucose load in an attempt to duplicate the in vivo test data of Finkelstein, et al (27), (see Figures 20a through 20d and 21a

through 21f. The high initial body glucose concentrations, resulting from the glucose load, were brought back to the basal concentration levels by the many biological mechanisms of the body.

The third set of data was an attempt to duplicate the in vivo test data of de Bodo, et al (16), (see Figures 14 and 15), by injecting insulin into the system at different rates over an extended period of time. The resulting excessively high body insulin concentrations caused the body glucose concentration level to be depressed, (see Figures 22a through 22c, and 23a through 23c). A description for each of the three test conditions for the dynamic model of the Glucose-Insulin-Glucagon System follows.

Basal Test

Figures 18a through 18f show basal data for the major data points of the Glucose-Insulin-Glucagon System model over a period of 150 minutes. The initial glycogen storage (EW3LI) for the liver was the near equilibrium value of 16 gm. The (6.72 gm/min) rate of glucose production from amino acid (GR22L2) is lower than the normal basal level of (13.0 mg/min) due to the "Cori" cycle lactate glucose load requirement of (6.25 mg/min) not being included in the Glucose-Insulin-Glucagon System model. Had this glucose load been included, the glucose concentration would have been reduced approximately 0.14 mg/ml, increasing the (GR22L2) output by approximately 7.0 gm/min to the basal level of 13.0 gm/min due to the change in (GR22L2) with respect to the change in glucose concentration being -47.8 (mg/min)/(mg/ml).

Figures 19a through 19c show the dynamic equilibrium for the liver glycogen storage (EW3L) for initial glycogen storage (EW3LI) levels of 0.0, 10.0, and 19.25 gm, respectively. This data demonstrates the dynamic characteristic of the liver glycogen storage as revealed in the data of Mortimore (49), (see Figure 12). For glycogen storage (EW3L) levels (0.0, 10.0 gm), below the near equilibrium value of 16 gm, glycogen was produced from glucose (SEW3L) at higher rates (10.7, 5.8 mg/min, @ t = 27) than the rate at which glucose was produced from glycogen (0.0, 0.0 mg/min, @ t = 27). The (SEW3L) rate varied primarily as a function of the difference between the equilibrium and the actual liver glycogen storage (EW3L). For the condition where the actual liver glycogen storage (EW3L) level (19.25 gm) was greater than the equilibrium glycogen storage level, glucose was produced from glycogen (GR22L1) at a much higher rate (9.6 mg/min, @ t = 27) than was glycogen produced from glucose (SEW3L) (1.8 mg/min, @ t = 27).

For the test runs of Figures 19a through 19c, a glucose load of 8.75 gm was also injected evenly into blood plasma volume (V1S) of the left side of the heart during the period t = 28.45 to t = 29.95. Over the following 120 minutes, approximately 5.3, 4.3, 2.6 gm of glucose had been converted to glycogen by the liver for initial glycogen storage (EW3LI) levels of 0.0, 10.0, and 19.25 gm, respectively. Over the same period of time 1.4, 1.7, and 2.3 gm of glucose had been converted to glycogen in the muscle (EW3M) for initial liver glycogen levels of 0.0, 10.0, and 19.25, respectively.

Glucose Load Test

A glucose load was applied to the Glucose-Insulin-Glucagon System model so that the glucose dynamics test data obtained from the model could be compared with the in vivo test data obtained by Finkelstein, et al (27), (see Figures 20a through 20d), and the validity of the model determined.

A glucose load of 8.75 gm was injected into the blood plasma volume (V1S) of the left side of the heart during the period t = 28.45 to t = 29.95 minutes. To simulate the glycogen stored in the liver of a fasted canine, the initial liver glycogen storage (EW3LI) level was set at 10.0 gm. To simulate the test conditions of Finkelstein, the gastro-intestinal tract blood flow (BR11I, BR22I) was reduced from 532 ml/min to 229 ml/min and where necessary the blood flow was increased by approximately seventeen per cent to maintain the cardiac output at 2187 ml/min.

The Glucose-Insulin-Glucagon System model test results are shown in Figures 21a through 21f. The initial blood glucose concentration of approximately 3.5 mg/ml resulting from the glucose load of 8.75 gm, decays almost exponentially (τ = 50 min) to the basal concentration values of t = 27 over a 120 minute period. Approximately 4.2 gm of glucose have been converted to glycogen (EW3L) by the liver.

The data of Finkelstein (see Figures 20a through 20d) indicates a damped oscillatory type response to the glucose load for the glucose concentrations, particularly in the arterial flow, while all the glucose

concentration data for the Glucose-Insulin-Glucagon System model is nearly exponential.

For the Glucose-Insulin-Glucagon model the peak pancreatic insulin concentration output (IC22P), (see Figure 21d), is 36 ng/ml occurring approximately three minutes after the 8.75 gm glucose load, while for the data of Finkelstein, (see Figure 20c), the peak pancreatic insulin output concentration is approximately 48 ng/ml, occurring approximately 30 minutes after the glucose load. The magnitude of the insulin concentrations throughout the body for both the model and the in vivo test data are in close agreement, peaking at values between 2.5 to 3.0 ng/ml. Where there is disagreement is the time at which the peak insulin concentration occurs, usually being approximately 30 minutes after the glucose load for the in vivo test data of Finkelstein and 12 to 15 minutes for the Glucose-Insulin-Glucagon System model. The arterial insulin concentration for the in vivo test data of Finkelstein, (see Figure 20b), peaks at approximately 15 minutes but has a magnitude of 3.5 ng/ml.

Insulin Load Test

The first insulin load test of the Glucose-Insulin-Glucagon System model was performed to simulate the test data of de Bodo, et al (16), (see Figure 14). An insulin load of 3900 ng/min was injected into the blood plasma volume (V1S) of the left side of the heart from t = 29.95 to t = 49.95, and then an insulin load of 1950 ng/min from t = 49.95 to t = 164.95. The response of the Glucose-Insulin-Glucagon System model to this insulin load is shown in

Figures 22a through 22c. There is good agreement between the in vivo test data of de Bodo and the test data for the Glucose-Insulin-Glucagon System model. The glucose concentration from t = 49.95 to t = 164.95 for the model is between 0.35 and 0.45 mg/ml while the in vivo test data has level of approximately 0.4 mg/ml. The falling and rising transition times for the model are 35 and 95 minutes, respectively, while for the in vivo data these transition times are 25 and 70 minutes. The waveshape for the muscle glucose concentration (GC1M), (see Figure 22c), is of a damped oscillatory nature, resembling the in vivo test data waveshape of de Bodo, (see Figure 14).

The liver glucose production at t = 140 increased by a factor of almost three from a basal level of 16.3 mg/min to 43.1 mg/min. The in vivo data showed an increase of approximately two.

The second insulin load test was an attempt to simulate the in vivo test data of de Bodo, et al (16), (see Figure 15). An insulin load of 778 ng/min was injected into the blood plasma volume (V1S) of the left side of the heart in the Glucose-Insulin-Glucagon System model from t = 29.95 to t = 119.95 period. The response for the glucose concentration level of the model is shown in Figures 23a through 23c. For the in vivo test data of de Bodo (see Figure 15), the glucose concentration changed at a rate of approximately -5.0×10^{-3} (mg/ml)/min during the period of time when insulin was being injected into the canine, while for the Glucose-Insulin-Glucagon System model the glucose concentration rate changed at a rate of approximately -3.0×10^{-3} (mg/ml)/min.

The recovery transition time back to basal glucose concentration levels once the insulin load had been stopped was approximately 45 minutes for the Glucose-Insulin-Glucagon System model and 30 minutes for the in vivo test data of de Bodo. The glucose concentration for the in vivo test did not return to the original basal level but was higher by approximately 0.05 mg/ml.

The liver glucose production throughout the period of the insulin load (778 ng/min) remained constant for the Glucose-Insulin-Glucagon System model which is in good agreement with the in vivo test data of de Bodo.

SECTION IX

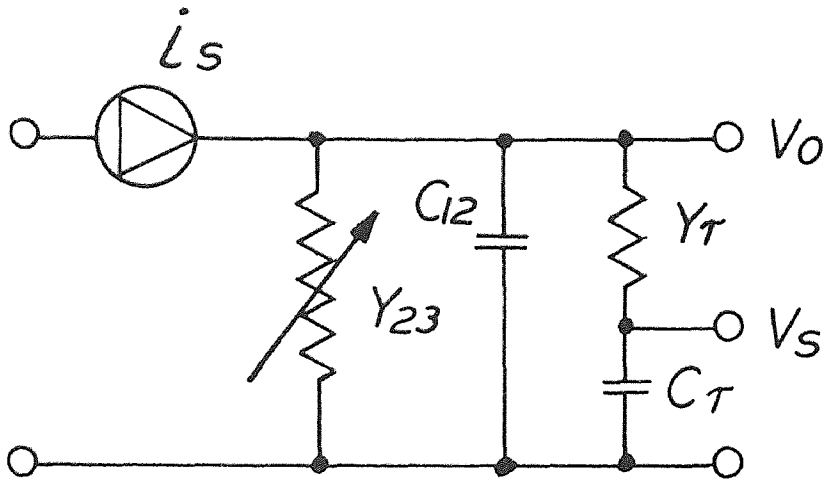
CONCLUSIONS AND RECOMMENDATIONS

The Basal Test results for the Glucose-Insulin-Glucagon System model demonstrates the dynamic equilibrium that exists between the level of glycogen stored (EW3L) in the liver, the glucose (GC1L), and insulin (IC1L) concentrations of the blood plasma perfusing the liver. For the Glucose-Insulin-Glucagon System model the equilibrium glycogen storate (EW3L) of the liver is approximately 16 gm, as a result of a stable supply of glucose substrates from the many body sources. Had the long term body functions involved in the glucose dynamics also been modeled, as these glucose substrate sources depleted with time, the blood plasma glucose and insulin concentrations would also have diminished, causing the liver glycogen storage equilibrium level to also be reduced.

For the Glucose Load Test the glucose concentration response of the Glucose-Insulin-Glucagon System model to a 8.75 gm glucose load was basically exponential back to the original basal glucose concentration level of 1.0 mg/ml, (see Figures 21a through 21f). The response for the in vivo test data of Finkelstein, (see Figures 20a through 20d), for a glucose load was also exponential throughout most of the canine with the exception for the data of the arterial flow; here a damped oscillation was observed. The damped oscillation for the arterial flow of the in vivo data is probably caused by either the insulin caused, delayed modulation of the 23.0 mg/min glucose load requirement of the head, or a glucose load requirement

for the lungs modulated by a delayed insulin response. (This type response has been observed for the muscle glucose concentration (GC1M) for the Insulin Load Test, see Figure 22c.) For the Glucose-Insulin-Glucagon System model, the 23.0 gm/min glucose load requirement for the head remained nearly fixed for all levels of both glucose and insulin concentration perfusing the head, while there was no glucose requirement for the lungs other than the glucose needed to bring the blood plasma (V1R) and the interstitial fluid (V2R) of the lungs into equilibrium with the rest of the system.

A possible mode of action for the damped oscillatory response of the arterial flow for the in vivo data, would be the delayed response for the insulin controlled active transport of glucose into the intracellular fluid of either the head or the lungs (V3C, V3R). An electrical analog is shown below of a non-linear



system which duplicates many of the characteristics of the active transport glucose dynamics. The response of this electical analog to a step input of glucose ($\mathcal{L}$ s) is a damped oscillation, where the magnitude of the first overshoot is controlled by the time constant ($\tau = C_T/Y_T$). The voltage Vs controls the glucose admittance (Y23) between the interstitial fluid and the intracellular fluid. The capacitor C_{12} represents the sum of the blood plasma and interstitial volumes.

One aspect of blood flow throughout the circulatory system that has not been modeled is the Laminar flow through the arteries, capillaries, and veins. The Laminar flow, together with the higher concentration of red blood cells in the center of the flow (31), would cause the blood concentrates to be distributed throughout the body at a slower effective rate, and for the Laminar flow of blood to exhibit the characteristics of a dynamic reservoir.

For the two tests in the Insulin Load Test there is generally good agreement between the in vivo test data of de Bodo (see Figures 14 and 15), and the data from the Glucose-Insulin-Glucagon System Model. Had the 6.25 mg/min lactate glucose load requirement (Cori cycle) been included in the Glucose-Insulin-Glucagon System model, the test data for the model would have been in closer agreement with the in vivo test data.

The inclusion of the 6.25 mg/min lactate glucose load to the liver glucose production would have meant a near two-fold increase

in the liver glucose production (22.6 mg/min to 49.4 mg/min) between the basal and 1950 ng/min insulin load periods, and lowered the depressed glucose concentration level below 9.45 mg/ml, thus being in closer agreement with the in vivo test data.

The inclusion of the 6.25 mg/min lactate glucose load requirement would also have increased the rate (-3.0×10^{-3} (mg/ml)/min at which the glucose concentration was changing due to the 778 ng/min insulin load bringing this rate closer to the (-5.0×10^{-3} (mg/ml)/min) rate for the in vivo test data. (The -3.0×10^{-3} (mg/ml/min) figure is probably more of a result of the muscle model causing glucose to be absorbed by the muscle at 0.27%/min rather than the 0.55%/min that was calculated from the data of (16).)

The 6.25 mg/min lactate glucose load requirement will have little effect on the transition response during the 3900 ng/min insulin load, but will further degrade the recovery response by approximately 20%.

The fact that for the in vivo test data of de Bodo, (see Figures 14 and 15), the recovery, after removing the insulin load, of the glucose concentration was to levels higher than the original basal glucose concentration indicates that either new glucose sources have been made available to the system or that the canine's glucose load requirment has been reduced as a result of the high insulin concentration, and that these insulin caused effects have not recovered to their basal levels.

Major improvements to the Glucose-Insulin-Glucagon System model could be made by incorporating into the model features that would account for the damped oscillatory response observed in the in vivo test data of Finkelstein, (see Figures 20a through 20d) for the glucose concentration of the arterial blood flow, and also the elevated glucose concentration for the arterial blood flow as compared to the rest of the canine.

Modeling the adrenal and the effects that both adrenaline and glucocorticoids have on the gluconeogenic substrates and the liver production of glucose would also make the model more accurate and complete.

```
****CONTINUOUS SYSTEM MODELING PROGRAM****

***PROBLEM INPUT STATEMENTS***

CONSTANT E=2.7182818928,...
GLOAD=0.0,...
HK=0.727,...
 V1=1177.0,V2=2840.0,V3=7966.0,...
BR22C=322.0, BR22P=46.0, BR22I=486.0, BR11L=808.0,...
BR11F=2187.0, BR11R=2187., BR22R=2187.0, BR11S=2187.0, BR22S=2187.0,...
BR22L=808.0, BR22M=410.0, BR22K=647.0, BR1VC=1865.0,...
BR22F=2187.0, BR11K=647.0,...
BR11C=322.0, BR11P=46.0, HEPART=276.0, BR11I=486.0, BR11M=410.0,...
GR22L4=2.78,...
V1C=23.0, V2C=74.0, V3C=204.0,...
GK12C=75.6, GK23C=33.3,...
 IK12C=24.8, IK23C=10.5,...
AK12C=24.8, AK23C=10.5,...
GC1CI=1.0, GC2CI=1.0, GC3CI=1.0,...
IC1CI=0.5, IC2CI=0.5, IC3CI=0.5,...
AC1CI=0.06, AC2CI=0.06, AC3CI=0.06,...
V1S=74.0, V2S=24.0, V3S=63.0,...
GK12S=15.2,...
IK12S=15.2, IK23S=4.25,...
AK12S=15.2, AK23S=4.25,...
GC1SI=1.0, GC2SI=1.0, GC3SI=1.0,...
IC1SI=0.5, IC2SI=0.5, IC3SI=0.5,...
AC1SI=0.06, AC2SI=0.06, AC3SI=0.06,...
V1R=231.0, V2R=575.0, V3R=1318.0,...
GK12R=196.3,...
IK12R=196.3, IK23R=93.7,...
AK12R=196.3, AK23R=93.7,...
GC1RI=1.0, GC2RI=1.0, GC3RI=1.0,...
IC1RI=0.5, IC2RI=0.5, IC3RI=0.5,...
AC1RI=0.06, AC2RI=0.06, AC3RI=0.06,...
V1P=4.0, V2P=10.0, V3P=33.0,...
GK12P=4.0,...
IK12P=4.0, IK23P=1.8,...
AK12P=4.0, AK23P=1.8,...
GC1PI=1.0, GC2PI=1.0, GC3PI=1.0,...
IC1PI=0.5, IC2PI=0.5, IC3PI=0.5,...
AC1PI=0.06, AC2PI=0.06, AC3PI=0.06,...
V1I=54.0,V2I=154.0, V3I=537.0,...
GK12I=63.2,...
IK12I=63.2, IK23I=16.9,...
AK12I=63.2, AK23I=16.9,...
GC1II=1.0, GC2II=1.0, GC3II=1.0,...
IC1II=0.5, IC2II=0.5, IC3II=0.5,...
AC1II=0.06, AC2II=0.06, AC3II=0.06,...
V1L=41.0, V2L=109.0, V3L=305.0,...
GK12L=35.0,...
IK12L=36.0, IK23L=17.1,...
AK12L=36.0, AK23L=17.1,...
GC1LI=1.0, GC2LI=1.0, GC3LI=1.0,...
IC1LI=0.5, IC2LI=0.5, IC3LI=0.5,...
AC1LI=0.06, AC2LI=0.06, AC3LI=0.06,...
EK3LI=15000.0,...
EK3MI=0.0,...
V1M=529.0, V2M=1407.0, V3M=3920.0,...
GK12M=462.5,...
```

FIGURE 17a COMPUTER PROGRAM

```
      IK12M=2000.0, IK23M=400.0,...
      AK12M=2000.0, AK23M=400.0,...
      GC1MI=1.0, GC2MI=1.0, GC3MI=1.0,...
      IC1MI=0.5, IC2MI=0.5, IC3MI=0.5,...
      AC1MI=0.06, AC2MI=0.06, AC3MI=0.06,...
      V1M=137.0, V2M=363.0, V3M=1020.0,...
      GK12K=120.8,...
      IK12K=120.8, IK23K=52.1,...
      AK12K=120.8, AK23K=52.1,...
      GC1KI=1.0, GC2KI=1.0, GC3KI=1.0,...
      IC1KI=0.5, IC2KI=0.5, IC3KI=0.5, ...
      AC1KI=0.06, AC2KI=0.06, AC3KI=0.06,...
      V1F=74.0,V2F=24.0, V3F=63.0,...
      GK12F=15.2,...
      IK12F=15.2, IK23F=4.25,...
      AK12F=15.2, AK23F=4.25,...
      GC1FI=1.0, GC2FI=1.0, GC3FI=1.0,...
      IC1FI=0.5, IC2FI=0.5, IC3FI=0.5,...
      AC1FI=0.06, AC2FI=0.06, AC3FI=0.06

      SGW1F=((GC11F)*(BR11F)-(GC1F)*(BR22F))*(HK)-(GC1F-GC2F)*(GK12F)
      GW1F=INTGRL(0.0,SGW1F)
      GC1F=GC1FI+(GW1F)/(V1F)
      SGW2F=(GC1F-GC2F)*(GK12F)
      GW2F=INTGRL(0.0,SGW2F)
      GC2F=GC2FI+(GW2F)/(V2F)
      SIW1F=((IC11F)*(BR11F)-(IC1F)*(BR22F))*(HK)-(IC1F-IC2F)*(IK12F)
      IW1F=INTGRL(0.0,SIW1F)
      IC1F=IC1FI+(IW1F)/(V1F)
      SIW2F=(IC1F-IC2F)*(IK12F)-(IC2F)*(IK23F)
      IW2F=INTGRL(0.0,SIW2F)
      IC2F=IC2FI+(IW2F)/(V2F)
      SAW1F=((AC11F)*(BR11F)-(AC1F)*(BR22F))*(HK)-(AC1F-AC2F)*(AK12F)
      AW1F=INTGRL(0.0,SAW1F)
      AC1F=AC1FI+AW1F/V1F
      SAW2F=(AC1F-AC2F)*(AK12F)-(AC2F)*(AK23F)
      AW2F=INTGRL(0.0,SAW2F)
      AC2F=AC2FI+(AW2F)/(V2F)
      SGW1R=((GC1F)*(BR11R)-(GC1R)*(BR22R))*(HK)-(GC1R-GC2R)*(GK12R)
      GW1R=INTGRL(0.0,SGW1R)
      GC1R=GC1RI+(GW1R)/(V1R)
      SGW2R=(GC1R-GC2R)*(GK12R)
      GW2R=INTGRL(0.0,SGW2R)
      GC2R=GC2RI+(GW2R)/(V2R)
      SIW1R=((IC1F)*(BR11R)-(IC1R)*(BR22R))*(HK)-(IC1R-IC2R)*(IK12R)
      IW1R=INTGRL(0.0,SIW1R)
      IC1R=IC1RI+(IW1R)/(V1R)
      SIW2R=(IC1R-IC2R)*(IK12R)-(IC2R)*(IK23R)
      IW2R=INTGRL(0.0,SIW2R)
      IC2R=IC2RI+(IW2R)/(V2R)
      SAW1R=((AC1F)*(BR11F)-(AC1R)*(BR22R))*(HK)-(AC1R-AC2R)*(AK12R)
      AW1R=INTGRL(0.0,SAW1R)
      AC1R=AC1RI+AW1R/V1R
      SAW2R=(AC1R-AC2R)*(AK12R)-(AC2R)*(AK23R)
      AW2R=INTGRL(0.0,SAW2R)
      AC2R=AC2RI+(AW2R)/(V2R)
      ILOAD=(3900.0)*(INJECT)
      INJECT=A-0.5*B-0.5*C
      A=STEP(29.95)
      B=STEP(49.95)
      C=STEP(164.95)
```

FIGURE 17b COMPUTER PROGRAM

```
      SGW1S=((GC1R)*(BR11S)-(GC1S)*(BR22S))*(HK)-(GC1S-GC2S)*(GK12S)+GLOAD
      GW1S=INTGRL(0.0,SGW1S)
      GC1S=GC1SI+(GW1S)/(V1S)
      SGW2S=(GC1S-GC2S)*(GK12S)
      GW2S=INTGRL(0.0,SGW2S)
      GC2S=GC2SI+(GW2S)/(V2S)
      SIW1S=((IC1R)*(BR11S)-(IC1S)*(BR22S))*(HK)-(IC1S-IC2S)*(IK12S)+ILOAD
      IW1S=INTGRL(0.0,SIW1S)
      IC1S=IC1SI+(IW1S)/(V1S)
      SIW2S=(IC1S-IC2S)*(IK12S)-(IC2S)*(IK23S)
      IW2S=INTGRL(0.0,SIW2S)
      IC2S=IC2SI+(IW2S)/(V2S)
      SAW1S=((AC1R)*(BR11S)-(AC1S)*(BR22S))*(HK)-(AC1S-AC2S)*(AK12S)
      AW1S=INTGRL(0.0,SAW1S)
      AC1S=AC1SI+AW1S/V1S
     SAW2S=(AC1S-AC2S)*(AK12S)-(AC2S)*(AK23S)
      AW2S=INTGRL(0.0,SAW2S)
      AC2S=AC2SI+(AW2S)/(V2S)
      GC11F=((GC1C)*(BR22C)+(GC1VC)*(BR1VC))/BR11F
      IC11F=((IC1L)*(BR22C)+(IC1VC)*(BR1VC))/(BR11F)
      AC11F=((AC1C)*(BR22C)+(AC1VC)*(BR1VC))/(BR11F)
      GC11L=((GC1P)*(BR22P)+(GC1S)*(HEPART)+(GC11)*(BR22I))/(BR11L)
      IC11L=((IC22P)*(BR22P)+(IC1S)*(HEPART)+(IC11)*(BR22I))/(BR11L)
      AC11L=((AC22P)*(BR22P)+(AC1S)*(HEPART)+(AC11)*(BR22I))/(BR11L)
      GC1VC=((GC22L)*(BR22L)+(GC1M)*(BR22M)+(GC1K)*(BR22K))/BR1VC
      IC1VC=((IC1L)*(BR22L)+(IC1M)*(BR22M)+(IC1K)*(BR22K))/(BR1VC)
      AC1VC=((AC1L)*(BR22L)+(AC1M)*(BR22M)+(AC1K)*(BR22K))/(BR1VC)
      SGW1C=((GC1S)*(BR11C)-(GC1C)*(BR22C))*(HK)-(GC1C-GC2C)*(GK12C)
      GW1C=INTGRL(0.0,SGW1C)
      GC1C=GC1C1+GW1C/V1C
      GR1C=(GC1S-GC1C1)*(BR11C)
      SGW2C=(GC1C-GC2C)*(GK12C)-(GC2C-GC3C)*(GK23C)
      GW2C=INTGRL(0.0,SGW2C)
      GC2C=GC2C1+(GW2C)/(V2C)
      SGW3C=(GC2C-GC3C)*(GK23C)-23.0
      GW3C=INTGRL(0.0,SGW3C)
      GC3C=GC3C1+(GW3C)/(V3C)
      SIW1C=((IC1S)*(BR11C)-(IC1C)*(BR22C))*(HK)-(IC1C-IC2C)*(IK12C)
      IW1C=INTGRL(0.0,SIW1C)
      IC1C=IC1C1+(IW1C)/(V1C)
      SIW2C=(IC1C-IC2C)*(IK12C)-(IC2C)*(IK23C)
      IW2C=INTGRL(0.0,SIW2C)
      IC2C=IC2C1+(IW2C)/(V2C)
      SAW1C=((AC1S)*(BR11C)-(AC1C)*(BR22C))*(HK)-(AC1C-AC2C)*(AK12C)
      AW1C=INTGRL(0.0,SAW1C)
      AC1C=AC1C1+AW1C/V1C
      SAW2C=(AC1C-AC2C)*(AK12C)-(AC2C)*(AK23C)
      AW2C=INTGRL(0.0,SAW2C)
      AC2C=AC2C1+(AW2C)/(V2C)
      SGW1P=((GC1S)*(BR11P)-(GC1P)*(BR22P))*(HK)-(GC1P-GC2P)*(GK12P)
      GW1P=INTGRL(0.0,SGW1P)
     GC1P=GC1P1+(GW1P)/(V1P)
     SGW2P=(GC1P-GC2P)*(GK12P)
      GW2P=INTGRL(0.0,SGW2P)
      GC2P=GC2P1+(GW2P)/(V2P)
       IR=(525.0)*(GC1P)-384.0
       LIK=LIMIT(0.0,1300.0,IR)
       AR=(60.0)*(1.0-0.72*GC1P)
       LAR=LIMIT(0.0,60.0,AR)
      SIW1P=((IC1S)*(BR11P)-(IC1P)*(BR22P))*(HK)-(IC1P-IC2P)*(IK12P)
      IW1P=INTGRL(0.0,SIW1P)
```

FIGURE 17c COMPUTER PROGRAM

```
IC1P=IC1P1+(IW1P)/(V1P)
 IC22P=IC1P+LIR/(BR22P*HK)
SIW2P=(IC1P-IC2P)*(IK12P)-(IC2P)*(IK23P)
IW2P=INTGRL(0.0,SIW2P)
IC2P=IC2P1+(IW2P)/(V2P)
SAW1P=((AC1S)*(BR11P)-(AC1P)*(BR22P))*(HK)-(AC1P-AC2P)*(AK12P)
AW1P=INTGRL(0.0,SAW1P)
AC1P=AC1P1+AW1P/(V1P)
 AC22P=AC1P+LAR/(BR22P*HK)
SAW2P=(AC1P-AC2P)*(AK12P)-(AC2P)*(AK23P)
AW2P=INTGRL(0.0,SAW2P)
AC2P=AC2P1+(AW2P)/(V2P)
SGW1I=((GC1S)*(BR11I)-(GC1I)*(BR22I))*(HK)-(GC1I-GC2I)*(GK12I)
GW1I=INTGRL(0.0,SGW1I)
GC1I=GC1II+(GW1I)/(V1I)
SGW2I=(GC1I-GC2I)*(GK12I)
GW2I=INTGRL(0.0,SGW2I)
GC2I=GC2II+(GW2I)/(V2I)
SIW1I=((IC1S)*(BR11I)-(IC1I)*(BR22I))*(HK)-(IC1I-IC2I)*(IK12I)
IW1I=INTGRL(0.0,SIW1I)
IC1I=IC1II+(IW1I)/(V1I)
SIW2I=(IC1I-IC2I)*(IK12I)-(IC2I)*(IK23I)
IW2I=INTGRL(0.0,SIW2I)
IC2I=IC2II+(IW2I)/(V2I)
SAW1I=((AC1S)*(BR11I)-(AC1I)*(BR22I))*(HK)-(AC1I-AC2I)*(AK12I)
AW1I=INTGRL(0.0,SAW1I)
AC1I=AC1II+AW1I/V1I
SAW2I=(AC1I-AC2I)*(AK12I)-(AC2I)*(AK23I)
AW2I=INTGRL(0.0,SAW2I)
AC2I=AC2II+(AW2I)/(V2I)
SGW1L=((GC1S)*(BR11L)-(GC1L)*(BR22L))*(HK)-(GC1L-GC2L)*(GK12L)
GW1L=INTGRL(0.0,SGW1L)
GC1L=GC1LI+(GW1L)/(V1L)
SGW2L=(GC1L-GC2L)*(GK12L)-SEW3L
GW2L=INTGRL(0.0,SGW2L)
GC2L=GC2LI+(GW2L)/(V2L)
SIW1L=((IC1S)*(BR11L)-(IC1L)*(BR22L))*(HK)-(IC1L-IC2L)*(IK12L)
IW1L=INTGRL(0.0,SIW1L)
IC1L=IC1LI+(IW1L)/(V1L)
SIW2L=(IC1L-IC2L)*(IK12L)-(IC2L)*(IK23L)
IW2L=INTGRL(0.0,SIW2L)
IC2L=IC2LI+(IW2L)/(V2L)
SAW1L=((AC1S)*(BR11L)-(AC1L)*(BR22L))*(HK)-(AC1L-AC2L)*(AK12L)
AW1L=INTGRL(0.0,SAW1L)
AC1L=AC1LI+AW1L/(V1L)
SAW2L=(AC1L-AC2L)*(AK12L)-(AC2L)*(AK23L)
AW2L=INTGRL(0.0,SAW2L)
AC2L=AC2LI+(AW2L)/(V2L)
SEW3L=(137.5)*(GC1L/4.0)*(1.0-1.0/E**(IC1L/2.0))*(GLUGLY)
GLYSTD=(1.0-((EW3L/550.0)/GC1L**(0.5))/((0.029)*(1.5-0.5/E**...
(IC1L/1.56))))
EWL=INTGRL(0.0,SEW3L)
EW3L=(EW3LI+EWL)/1000.0  -GW22LI/1000.0
GLUGLY=LIMIT(0.0,1.0,GLYSTD)
GR22LI=(167.0)*(1.0-1.0/E**(EW3L/4.5))*(1.0-1.0/E**(AC1L/0.20))*(GLGL)
FACTOR=(1.0-(GC1L)*100.00*(3.0-2.1/E**(IC1L/0.78))/((0.9)...
*(0.65*EW3L)**2.4))
GLGL=LIMIT(0.0,1.0,FACTOR)
GW22LI=INTGRL(0.0,GR22LI)
GR22L2=(131.0)*(1.0-1.0/E**(AAN**3.0/10.0))
GW22L2=INTGRL(0.0,GR22L2)
```

FIGURE 17d COMPUTER PROGRAM

```
      AAN=(1.5)*(1.0-1.0/E**(AC1M/0.07))*(1.0+1.0/E**(IC1M**2.0))
      GR22L3=5.67*(0.5+2.5*(1.-1.0/E**(AC1L/0.41)))*(1.0+0.5/E**(IC1L/0.78))
      GR22L3=INTGRL(0.0,GR22L3)
      GC22L=GC1L+(GR22L1+GR22L2+GR22L3+GR22L4)/(BR22L*HK)
      GRIN=GR22L1+GR22L2+GR22L3+GR22L4+6.25
      GROUT=23.0+SEW3L+SEW3M
      GRDELT=GRIN-GROUT
      SGW1M=((GC1S)*(BR11M)-(GC1M)*(BR22M))*(HK)-(GC1M-GC2M)*(GK12M)
      GW1M=INTGRL(0.0,SGW1M)
      GC1M=GC1MI+(GW1M)/(V1M)
      SGW2M=(GC1M-GC2M)*(GK12M) -SEW3M
      GW2M=INTGRL(0.0,SGW2M)
      GC2M=GC2MI+(GW2M)/(V2M)
      GR23M=(V1+V2)*((IC2M*1.27)**2.51/1000.0
       SEW3M=(GR23M)*(GC2M)
      EWM=INTGRL(0.0,SEW3M)
      EW2M=EW3MI+EWM
      SIW1M=((IC1S)*(BR11M)-(IC1M)*(BR22M))*(HK)-(IC1M-IC2M)*(IK12M)
      IW1M=INTGRL(0.0,SIW1M)
      IC1M=IC1MI+(IW1M)/(V1M)
      SIW2M=(IC1M-IC2M)*(IK12M)-(IC2M)*(IK23M)
      IW2M=INTGRL(0.0,SIW2M)
      IC2M=IC2MI+(IW2M)/(V2M)
      SAW1M=((AC1S)*(BR11M)-(AC1M)*(BR22M))*(HK)-(AC1M-AC2M)*(AK12M)
      AW1M=INTGRL(0.0,SAW1M)
      AC1M=AC1MI+AW1M/(V1M)
      SAW2M=(AC1M-AC2M)*(AK12M)-(AC2M)*(AK23M)
      AW2M=INTGRL(0.0,SAW2M)
      AC2M=AC2MI+(AW2M)/(V2M)
      SGW1K=((GC1S)*(BR11K)-(GC1K)*(BR22K))*(HK)-(GC1K-GC2K)*(GK12K)+6.25
      GW1K=INTGRL(0.0,SGW1K)
      GC1K=GC1KI+(GW1K)/(V1K)
      SGW2K=(GC1K-GC2K)*(GK12K)
      GW2K=INTGRL(0.0,SGW2K)
      GC2K=GC2KI+(GW2K)/(V2K)
      SIW1K=((IC1S)*(BR11K)-(IC1K)*(BR22K))*(HK)-(IC1K-IC2K)*(IK12K)
      IW1K=INTGRL(0.0,SIW1K)
      IC1K=IC1KI+(IW1K)/(V1K)
      SIW2K=(IC1K-IC2K)*(IK12K)-(IC2K)*(IK23K)
      IW2K=INTGRL(0.0,SIW2K)
      IC2K=IC2KI+(IW2K)/(V2K)
      SAW1K=((AC1S)*(BR11K)-(AC1K)*(BR22K))*(HK)-(AC1K-AC2K)*(AK12K)
      AW1K=INTGRL(0.0,SAW1K)
      AC1K=AC1KI+AW1K/(V1K)
      SAW2K=(AC1K-AC2K)*(AK12K)-(AC2K)*(AK23K)
      AW2K=INTGRL(0.0,SAW2K)
      AC2K=AC2KI+(AW2K)/(V2K)

      METHOD RECT
      TIMER FINTIM=250.0, DELT=0.05, OUTDEL=5.0
       PRTPLT GC1C(IC1C,AC1C,GR1C), GC1S(AC1S,AAN,GC1VC)
       PRTPLT GC22L(GC11F,IC11F,AC11F), IC1S(GC1K,IC1K,AC1K)
       PRTPLT SEW3L(EW3L,GR22L1,ILUAD), GC11L(GR22L2,GR22L3,GR22L4)
       PRTPLT IC22P(L1K,L4K,GC1P), AC22P(GC1I,IC1I,AC1I)
       PRTPLT SEW3M(EW3M,GK23M,IC2K), GC1L(IC1L,AC1L)
       PRTPLT GC1M(IC1M,AC1M,GC2M), GRDELT(GRIN,GROUT,GC1R)
       END
       STOP

 OUTPUT VARIABLE SEQUENCE
```

FIGURE 17e COMPUTER PROGRAM

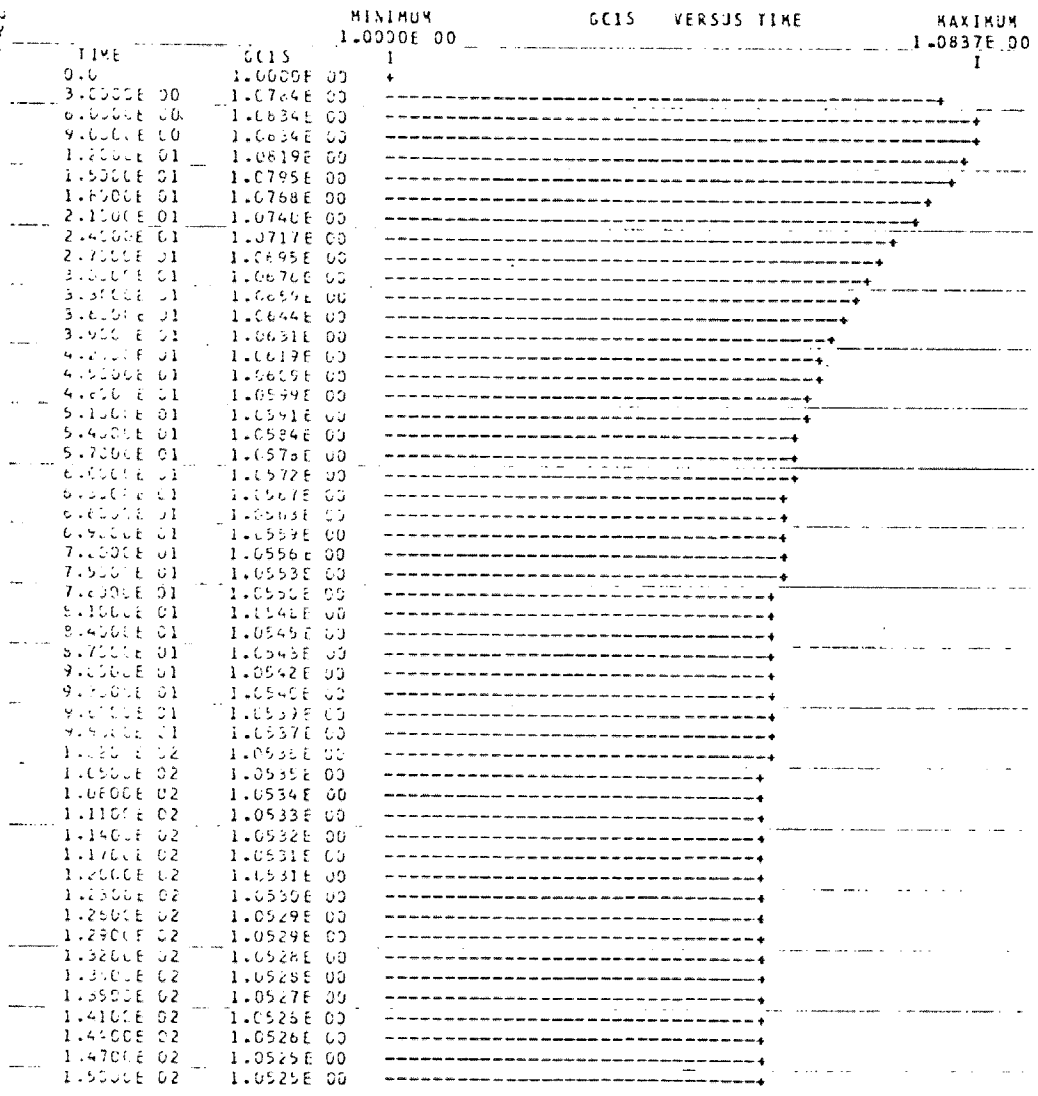
GCIC VERSUS TIME

MINIMUM 9.5427E-01 — MAXIMUM 1.0507E 00

TIME	GCIC		IC1C	AC1C	GR1C*
0.0	1.0000E 00	+	5.0000E-01	6.0000E-02	0.0
3.0000E 00	1.0496E 00	+	6.4110E-01	6.6863E-02	9.2951E 00
6.0000E 00	1.0360E 00	+	6.3364E-01	5.9174E-02	1.5274E 01
9.0000E 00	1.0223E 00	+	6.2402E-01	5.3729E-02	1.9696E 01
1.2000E 01	1.0108E 00	+	6.1596E-01	5.0104E-02	2.2879E 01
1.5000E 01	1.0013E 00	+	6.0909E-01	4.7782E-02	2.5172E 01
1.8000E 01	9.9345E-01	+	6.0288E-01	4.6361E-02	2.6830E 01
2.1000E 01	9.8695E-01	+	5.9712E-01	4.5548E-02	2.8044E 01
2.4000E 01	9.8180E-01	+	5.9191E-01	4.5120E-02	2.8940E 01
2.7000E 01	9.7782E-01	+	5.8722E-01	4.4937E-02	2.9600E 01
3.0000E 01	9.7419E-01	+	5.8299E-01	4.4907E-02	3.0086E 01
3.3000E 01	9.7135E-01	+	5.7919E-01	4.4968E-02	3.0449E 01
3.6000E 01	9.6901E-01	+	5.7579E-01	4.5081E-02	3.0719E 01
3.9000E 01	9.6704E-01	+	5.7275E-01	4.5220E-02	3.0923E 01
4.2000E 01	9.6539E-01	+	5.7005E-01	4.5368E-02	3.1075E 01
4.5000E 01	9.6399E-01	+	5.6766E-01	4.5516E-02	3.1192E 01
4.8000E 01	9.6280E-01	+	5.6554E-01	4.5658E-02	3.1280E 01
5.1000E 01	9.6176E-01	+	5.6366E-01	4.5791E-02	3.1349E 01
5.4000E 01	9.6090E-01	+	5.6200E-01	4.5913E-02	3.1402E 01
5.7000E 01	9.6015E-01	+	5.6053E-01	4.6024E-02	3.1444E 01
6.0000E 01	9.5949E-01	+	5.5924E-01	4.6124E-02	3.1477E 01
6.3000E 01	9.5892E-01	+	5.5809E-01	4.6214E-02	3.1502E 01
6.6000E 01	9.5841E-01	+	5.5708E-01	4.6294E-02	3.1524E 01
6.9000E 01	9.5798E-01	+	5.5618E-01	4.6366E-02	3.1540E 01
7.2000E 01	9.5759E-01	+	5.5539E-01	4.6430E-02	3.1555E 01
7.5000E 01	9.5725E-01	+	5.5466E-01	4.6487E-02	3.1566E 01
7.8000E 01	9.5695E-01	+	5.5406E-01	4.6538E-02	3.1575E 01
8.1000E 01	9.5668E-01	+	5.5350E-01	4.6584E-02	3.1583E 01
8.4000E 01	9.5644E-01	+	5.5300E-01	4.6624E-02	3.1590E 01
8.7000E 01	9.5623E-01	+	5.5256E-01	4.6660E-02	3.1595E 01
9.0000E 01	9.5604E-01	+	5.5216E-01	4.6693E-02	3.1601E 01
9.3000E 01	9.5588E-01	+	5.5181E-01	4.6722E-02	3.1605E 01
9.6000E 01	9.5571E-01	+	5.5149E-01	4.6748E-02	3.1608E 01
9.9000E 01	9.5557E-01	+	5.5120E-01	4.6772E-02	3.1611E 01
1.0200E 02	9.5544E-01	+	5.5094E-01	4.6793E-02	3.1614E 01
1.0500E 02	9.5532E-01	+	5.5070E-01	4.6812E-02	3.1616E 01
1.0800E 02	9.5521E-01	+	5.5049E-01	4.6830E-02	3.1616E 01
1.1100E 02	9.5512E-01	+	5.5029E-01	4.6846E-02	3.1620E 01
1.1400E 02	9.5503E-01	+	5.5011E-01	4.6861E-02	3.1621E 01
1.1700E 02	9.5494E-01	+	5.4994E-01	4.6875E-02	3.1622E 01
1.2000E 02	9.5486E-01	+	5.4979E-01	4.6888E-02	3.1623E 01
1.2300E 02	9.5479E-01	+	5.4965E-01	4.6899E-02	3.1624E 01
1.2600E 02	9.5472E-01	+	5.4951E-01	4.6910E-02	3.1625E 01
1.2900E 02	9.5465E-01	+	5.4939E-01	4.6920E-02	3.1626E 01
1.3200E 02	9.5459E-01	+	5.4927E-01	4.6930E-02	3.1626E 01
1.3500E 02	9.5453E-01	+	5.4916E-01	4.6939E-02	3.1627E 01
1.3800E 02	9.5448E-01	+	5.4905E-01	4.6946E-02	3.1627E 01
1.4100E 02	9.5442E-01	+	5.4895E-01	4.6956E-02	3.1628E 01
1.4400E 02	9.5437E-01	+	5.4886E-01	4.6964E-02	3.1628E 01
1.4700E 02	9.5432E-01	+	5.4877E-01	4.6971E-02	3.1628E 01
1.5000E 02	9.5427E-01	+	5.4868E-01	4.6978E-02	3.1629E 01

FIGURE 18a (1) BASAL TEST

*To correct, multiply by HK, (0.727).



TIME	GCIS	ACIS	AAN	GCIVC
0.0	1.0000E 00	6.0000E-02	1.5359E 00	1.0441E 00
3.0000E 00	1.0764E 00	6.8288E-02	1.2852E 00	1.0908E 00
6.0000E 00	1.0634E 00	6.0434E-02	1.0954E 00	1.0946E 00
9.0000E 00	1.0634E 00	5.4978E-02	9.7325E-01	1.0950E 00
1.2000E 01	1.0819E 00	5.1381E-02	8.9463E-01	1.0942E 00
1.5000E 01	1.0795E 00	4.9092E-02	8.4411E-01	1.0926E 00
1.8000E 01	1.0768E 00	4.7701E-02	8.1230E-01	1.0905E 00
2.1000E 01	1.0746E 00	4.6913E-02	7.9311E-01	1.0884E 00
2.4000E 01	1.0717E 00	4.6505E-02	7.8225E-01	1.0866E 00
2.7000E 01	1.0695E 00	4.6337E-02	7.7675E-01	1.0848E 00
3.0000E 01	1.0676E 00	4.6319E-02	7.7466E-01	1.0832E 00
3.3000E 01	1.0659E 00	4.6390E-02	7.7469E-01	1.0816E 00
3.6000E 01	1.0644E 00	4.6511E-02	7.7595E-01	1.0805E 00
3.9000E 01	1.0631E 00	4.6656E-02	7.7791E-01	1.0793E 00
4.2000E 01	1.0619E 00	4.6810E-02	7.8019E-01	1.0782E 00
4.5000E 01	1.0609E 00	4.6963E-02	7.8257E-01	1.0773E 00
4.8000E 01	1.0599E 00	4.7109E-02	7.8491E-01	1.0765E 00
5.1000E 01	1.0591E 00	4.7245E-02	7.8714E-01	1.0757E 00
5.4000E 01	1.0584E 00	4.7370E-02	7.8920E-01	1.0751E 00
5.7000E 01	1.0578E 00	4.7483E-02	7.9110E-01	1.0745E 00
6.0000E 01	1.0572E 00	4.7586E-02	7.9282E-01	1.0740E 00
6.3000E 01	1.0567E 00	4.7678E-02	7.9437E-01	1.0735E 00
6.6000E 01	1.0563E 00	4.7760E-02	7.9576E-01	1.0731E 00
6.9000E 01	1.0559E 00	4.7833E-02	7.9699E-01	1.0727E 00
7.2000E 01	1.0556E 00	4.7899E-02	7.9810E-01	1.0724E 00
7.5000E 01	1.0553E 00	4.7957E-02	7.9909E-01	1.0721E 00
7.8000E 01	1.0550E 00	4.8009E-02	7.9997E-01	1.0719E 00
8.1000E 01	1.0548E 00	4.8055E-02	8.0075E-01	1.0716E 00
8.4000E 01	1.0545E 00	4.8097E-02	8.0145E-01	1.0714E 00
8.7000E 01	1.0543E 00	4.8134E-02	8.0207E-01	1.0712E 00
9.0000E 01	1.0542E 00	4.8167E-02	8.0263E-01	1.0711E 00
9.3000E 01	1.0540E 00	4.8197E-02	8.0313E-01	1.0709E 00
9.6000E 01	1.0539E 00	4.8223E-02	8.0358E-01	1.0708E 00
9.9000E 01	1.0537E 00	4.8247E-02	8.0398E-01	1.0707E 00
1.0200E 02	1.0536E 00	4.8269E-02	8.0434E-01	1.0705E 00
1.0500E 02	1.0535E 00	4.8289E-02	8.0468E-01	1.0704E 00
1.0800E 02	1.0534E 00	4.8307E-02	8.0497E-01	1.0703E 00
1.1100E 02	1.0533E 00	4.8324E-02	8.0525E-01	1.0702E 00
1.1400E 02	1.0532E 00	4.8339E-02	8.0550E-01	1.0702E 00
1.1700E 02	1.0531E 00	4.8353E-02	8.0572E-01	1.0701E 00
1.2000E 02	1.0531E 00	4.8366E-02	8.0594E-01	1.0700E 00
1.2300E 02	1.0530E 00	4.8378E-02	8.0614E-01	1.0699E 00
1.2600E 02	1.0529E 00	4.8389E-02	8.0631E-01	1.0699E 00
1.2900E 02	1.0529E 00	4.8400E-02	8.0649E-01	1.0698E 00
1.3200E 02	1.0528E 00	4.8410E-02	8.0665E-01	1.0698E 00
1.3500E 02	1.0528E 00	4.8419E-02	8.0680E-01	1.0697E 00
1.3800E 02	1.0527E 00	4.8426E-02	8.0694E-01	1.0696E 00
1.4100E 02	1.0526E 00	4.8436E-02	8.0707E-01	1.0696E 00
1.4400E 02	1.0526E 00	4.8444E-02	8.0720E-01	1.0695E 00
1.4700E 02	1.0525E 00	4.8452E-02	8.0732E-01	1.0695E 00
1.5000E 02	1.0525E 00	4.8459E-02	8.0744E-01	1.0694E 00

FIGURE 18a (2) BASAL TEST

MINIMUM 1.0512E 00 GC22L VERSUS TIME MAXIMUM 1.1301E 00

TIME	GC22L	I	GC11F	IC11F	AC11F
0.0	1.1017E 00	----------+	1.0376E 00	5.0000E-01	6.0000E-02
3.6000E 00	1.1292E 00	----------+	1.0347E 00	6.9075E-01	6.9998E-02
6.6000E 00	1.1212E 00	----------+	1.0860E 00	6.8046E-01	6.2026E-02
9.6000E 00	1.1144E 00	----------+	1.0843E 00	6.7007E-01	5.6647E-02
1.2000E 01	1.1091E 00	----------+	1.0819E 00	6.6169E-01	5.3146E-02
1.5000E 01	1.1046E 00	----------+	1.0792E 00	6.5449E-01	5.0941E-02
1.8000E 01	1.1006E 00	----------+	1.0763E 00	6.4796E-01	4.9618E-02
2.1000E 01	1.0975E 00	----------+	1.0735E 00	6.4187E-01	4.8881E-02
2.4000E 01	1.0953E 00	----------+	1.0711E 00	6.3640E-01	4.8510E-02
2.7000E 01	1.0934E 00	----------+	1.0690E 00	6.3147E-01	4.8370E-02
3.0000E 01	1.0916E 00	----------+	1.0672E 00	6.2702E-01	4.8373E-02
3.3000E 01	1.0905E 00	---------+	1.0655E 00	6.2303E-01	4.8460E-02
3.6000E 01	1.0894E 00	---------+	1.0641E 00	6.1947E-01	4.8593E-02
3.9000E 01	1.0884E 00	---------+	1.0628E 00	6.1629E-01	4.8749E-02
4.2000E 01	1.0876E 00	--------+	1.0616E 00	6.1346E-01	4.8910E-02
4.5000E 01	1.0869E 00	--------+	1.0606E 00	6.1095E-01	4.9070E-02
4.8000E 01	1.0863E 00	--------+	1.0597E 00	6.0875E-01	4.9221E-02
5.1000E 01	1.0858E 00	--------+	1.0589E 00	6.0677E-01	4.9362E-02
5.4000E 01	1.0853E 00	--------+	1.0583E 00	6.0503E-01	4.9490E-02
5.7000E 01	1.0849E 00	--------+	1.0576E 00	6.0350E-01	4.9607E-02
6.0000E 01	1.0845E 00	--------+	1.0571E 00	6.0214E-01	4.9713E-02
6.3000E 01	1.0842E 00	--------+	1.0566E 00	6.0094E-01	4.9807E-02
6.6000E 01	1.0839E 00	--------+	1.0562E 00	5.9989E-01	4.9891E-02
6.9000E 01	1.0837E 00	--------+	1.0558E 00	5.9895E-01	4.9967E-02
7.2000E 01	1.0835E 00	--------+	1.0555E 00	5.9812E-01	5.0034E-02
7.5000E 01	1.0833E 00	--------+	1.0552E 00	5.9738E-01	5.0094E-02
7.8000E 01	1.0831E 00	--------+	1.0549E 00	5.9672E-01	5.0147E-02
8.1000E 01	1.0829E 00	--------+	1.0547E 00	5.9614E-01	5.0194E-02
8.4000E 01	1.0828E 00	--------+	1.0545E 00	5.9562E-01	5.0237E-02
8.7000E 01	1.0826E 00	--------+	1.0543E 00	5.9516E-01	5.0275E-02
9.0000E 01	1.0825E 00	--------+	1.0541E 00	5.9474E-01	5.0309E-02
9.3000E 01	1.0824E 00	--------+	1.0540E 00	5.9437E-01	5.0339E-02
9.6000E 01	1.0823E 00	--------+	1.0538E 00	5.9403E-01	5.0367E-02
9.9000E 01	1.0822E 00	--------+	1.0537E 00	5.9373E-01	5.0392E-02
1.0200E 02	1.0821E 00	--------+	1.0536E 00	5.9345E-01	5.0414E-02
1.0500E 02	1.0820E 00	--------+	1.0535E 00	5.9320E-01	5.0435E-02
1.0800E 02	1.0820E 00	--------+	1.0534E 00	5.9298E-01	5.0454E-02
1.1100E 02	1.0819E 00	--------+	1.0533E 00	5.9277E-01	5.0471E-02
1.1400E 02	1.0818E 00	--------+	1.0532E 00	5.9258E-01	5.0486E-02
1.1700E 02	1.0818E 00	--------+	1.0531E 00	5.9240E-01	5.0501E-02
1.2000E 02	1.0817E 00	--------+	1.0531E 00	5.9224E-01	5.0514E-02
1.2300E 02	1.0816E 00	--------+	1.0530E 00	5.9209E-01	5.0527E-02
1.2600E 02	1.0816E 00	--------+	1.0529E 00	5.9195E-01	5.0538E-02
1.2900E 02	1.0815E 00	--------+	1.0529E 00	5.9181E-01	5.0549E-02
1.3200E 02	1.0815E 00	--------+	1.0528E 00	5.9169E-01	5.0559E-02
1.3500E 02	1.0814E 00	--------+	1.0527E 00	5.9157E-01	5.0569E-02
1.3800E 02	1.0814E 00	--------+	1.0527E 00	5.9146E-01	5.0578E-02
1.4100E 02	1.0813E 00	--------+	1.0526E 00	5.9135E-01	5.0587E-02
1.4400E 02	1.0813E 00	--------+	1.0526E 00	5.9125E-01	5.0595E-02
1.4700E 02	1.0813E 00	--------+	1.0525E 00	5.9115E-01	5.0603E-02
1.5000E 02	1.0812E 00	--------+	1.0525E 00	5.9106E-01	5.0611E-02

FIGURE 18b (1) BASAL TEST

18b2

MINIMUM 4.9975E-01 — ICIS VERSUS TIME — MAXIMUM 6.6147E-01

TIME	ICIS	GCIK	ICIK	ACIK
0.0	5.0000E-01	1.0000E 00	5.0000E-01	6.0000E-02
3.0000E 00	6.6146E-01	1.0793E 00	6.1476E-01	6.5079E-02
6.0000E 00	6.5294E-01	1.0906E 00	6.0791E-01	5.7556E-02
9.0000E 00	6.4294E-01	1.0941E 00	5.9858E-01	5.2104E-02
1.2000E 01	6.3473E-01	1.0943E 00	5.9072E-01	4.9426E-02
1.5000E 01	6.2770E-01	1.0929E 00	5.8399E-01	4.6046E-02
1.8000E 01	6.2135E-01	1.0906E 00	5.7797E-01	4.4573E-02
2.1000E 01	6.1545E-01	1.0881E 00	5.7239E-01	4.3717E-02
2.4000E 01	6.1013E-01	1.0858E 00	5.6733E-01	4.3258E-02
2.7000E 01	6.0533E-01	1.0836E 00	5.6278E-01	4.3051E-02
3.0000E 01	6.0100E-01	1.0816E 00	5.5867E-01	4.3002E-02
3.3000E 01	5.9712E-01	1.0798E 00	5.5498E-01	4.3049E-02
3.6000E 01	5.9365E-01	1.0783E 00	5.5168E-01	4.3150E-02
3.9000E 01	5.9055E-01	1.0769E 00	5.4873E-01	4.3279E-02
4.2000E 01	5.8779E-01	1.0756E 00	5.4611E-01	4.3419E-02
4.5000E 01	5.8535E-01	1.0745E 00	5.4378E-01	4.3561E-02
4.8000E 01	5.8318E-01	1.0736E 00	5.4171E-01	4.3697E-02
5.1000E 01	5.8126E-01	1.0727E 00	5.3989E-01	4.3825E-02
5.4000E 01	5.7957E-01	1.0720E 00	5.3827E-01	4.3943E-02
5.7000E 01	5.7807E-01	1.0713E 00	5.3684E-01	4.4051E-02
6.0000E 01	5.7675E-01	1.0707E 00	5.3558E-01	4.4148E-02
6.3000E 01	5.7558E-01	1.0702E 00	5.3447E-01	4.4235E-02
6.6000E 01	5.7455E-01	1.0698E 00	5.3348E-01	4.4313E-02
6.9000E 01	5.7365E-01	1.0694E 00	5.3261E-01	4.4383E-02
7.2000E 01	5.7282E-01	1.0690E 00	5.3183E-01	4.4445E-02
7.5000E 01	5.7210E-01	1.0687E 00	5.3115E-01	4.4501E-02
7.8000E 01	5.7146E-01	1.0684E 00	5.3054E-01	4.4550E-02
8.1000E 01	5.7089E-01	1.0681E 00	5.3000E-01	4.4595E-02
8.4000E 01	5.7039E-01	1.0679E 00	5.2952E-01	4.4634E-02
8.7000E 01	5.6993E-01	1.0677E 00	5.2909E-01	4.4669E-02
9.0000E 01	5.6955E-01	1.0675E 00	5.2870E-01	4.4701E-02
9.3000E 01	5.6917E-01	1.0674E 00	5.2835E-01	4.4729E-02
9.6000E 01	5.6884E-01	1.0672E 00	5.2804E-01	4.4754E-02
9.9000E 01	5.6855E-01	1.0671E 00	5.2776E-01	4.4777E-02
1.0200E 02	5.6828E-01	1.0669E 00	5.2751E-01	4.4798E-02
1.0500E 02	5.6804E-01	1.0668E 00	5.2728E-01	4.4817E-02
1.0800E 02	5.6782E-01	1.0667E 00	5.2707E-01	4.4834E-02
1.1100E 02	5.6761E-01	1.0666E 00	5.2688E-01	4.4850E-02
1.1400E 02	5.6743E-01	1.0665E 00	5.2671E-01	4.4864E-02
1.1700E 02	5.6726E-01	1.0665E 00	5.2655E-01	4.4877E-02
1.2000E 02	5.6710E-01	1.0664E 00	5.2640E-01	4.4890E-02
1.2300E 02	5.6695E-01	1.0663E 00	5.2626E-01	4.4901E-02
1.2600E 02	5.6682E-01	1.0662E 00	5.2613E-01	4.4911E-02
1.2900E 02	5.6669E-01	1.0662E 00	5.2601E-01	4.4921E-02
1.3200E 02	5.6657E-01	1.0661E 00	5.2590E-01	4.4931E-02
1.3500E 02	5.6645E-01	1.0661E 00	5.2579E-01	4.4939E-02
1.3800E 02	5.6635E-01	1.0660E 00	5.2569E-01	4.4948E-02
1.4100E 02	5.6624E-01	1.0660E 00	5.2559E-01	4.4956E-02
1.4400E 02	5.6615E-01	1.0659E 00	5.2550E-01	4.4963E-02
1.4700E 02	5.6605E-01	1.0659E 00	5.2541E-01	4.4970E-02
1.5000E 02	5.6596E-01	1.0658E 00	5.2533E-01	4.4977E-02

FIGURE 18b (2) BASAL TEST

MINIMUM SEW3L VERSUS TIME MAXIMUM
8.9539E-01 2.9022E 00

TIME	SEW3L	I	EW3L	GR22LI	ILOAD
0.0	8.9539E-01	*	1.6000E 01	9.9878E 00	0.0
3.0000E 00	2.8337E 00		1.6002E 01	0.0	0.0
6.0000E 00	2.9022E 00		1.6010E 01	0.0	0.0
9.0000E 00	2.8778E 00		1.6019E 01	0.0	0.0
1.2000E 01	2.8316E 00		1.6026E 01	0.0	0.0
1.5000E 01	2.7762E 00		1.6036E 01	0.0	0.0
1.8000E 01	2.7165E 00		1.6044E 01	0.0	0.0
2.1000E 01	2.6619E 00		1.6052E 01	1.6975E-01	0.0
2.4000E 01	2.6117E 00		1.6059E 01	4.4111E-01	0.0
2.7000E 01	2.5667E 00		1.6065E 01	6.6536E-01	0.0
3.0000E 01	2.5266E 00		1.6071E 01	9.0538E-01	0.0
3.3000E 01	2.4916E 00		1.6075E 01	1.1026E 00	0.0
3.6000E 01	2.4594E 00		1.6079E 01	1.2787E 00	0.0
3.9000E 01	2.4316E 00		1.6082E 01	1.4358E 00	0.0
4.2000E 01	2.4072E 00		1.6085E 01	1.5752E 00	0.0
4.5000E 01	2.3858E 00		1.6087E 01	1.6984E 00	0.0
4.8000E 01	2.3670E 00		1.6089E 01	1.8072E 00	0.0
5.1000E 01	2.3506E 00		1.6091E 01	1.9027E 00	0.0
5.4000E 01	2.3361E 00		1.6092E 01	1.9869E 00	0.0
5.7000E 01	2.3235E 00		1.6093E 01	2.0607E 00	0.0
6.0000E 01	2.3125E 00		1.6093E 01	2.1251E 00	0.0
6.3000E 01	2.3028E 00		1.6094E 01	2.1817E 00	0.0
6.6000E 01	2.2944E 00		1.6094E 01	2.2307E 00	0.0
6.9000E 01	2.2869E 00		1.6094E 01	2.2736E 00	0.0
7.2000E 01	2.2804E 00		1.6094E 01	2.3110E 00	0.0
7.5000E 01	2.2746E 00		1.6094E 01	2.3433E 00	0.0
7.8000E 01	2.2698E 00		1.6094E 01	2.3712E 00	0.0
8.1000E 01	2.2654E 00		1.6093E 01	2.3955E 00	0.0
8.4000E 01	2.2616E 00		1.6092E 01	2.4163E 00	0.0
8.7000E 01	2.2583E 00		1.6092E 01	2.4344E 00	0.0
9.0000E 01	2.2553E 00		1.6092E 01	2.4497E 00	0.0
9.3000E 01	2.2527E 00		1.6091E 01	2.4628E 00	0.0
9.6000E 01	2.2506E 00		1.6091E 01	2.4740E 00	0.0
9.9000E 01	2.2486E 00		1.6090E 01	2.4835E 00	0.0
1.0200E 02	2.2467E 00		1.6089E 01	2.4917E 00	0.0
1.0500E 02	2.2452E 00		1.6089E 01	2.4988E 00	0.0
1.0800E 02	2.2438E 00		1.6086E 01	2.5036E 00	0.0
1.1100E 02	2.2426E 00		1.6087E 01	2.5085E 00	0.0
1.1400E 02	2.2416E 00		1.6086E 01	2.5119E 00	0.0
1.1700E 02	2.2407E 00		1.6085E 01	2.5149E 00	0.0
1.2000E 02	2.2398E 00		1.6084E 01	2.5176E 00	0.0
1.2300E 02	2.2391E 00		1.6084E 01	2.5188E 00	0.0
1.2600E 02	2.2385E 00		1.6083E 01	2.5200E 00	0.0
1.2900E 02	2.2379E 00		1.6082E 01	2.5206E 00	0.0
1.3200E 02	2.2373E 00		1.6081E 01	2.5211E 00	0.0
1.3500E 02	2.2369E 00		1.6080E 01	2.5210E 00	0.0
1.3800E 02	2.2365E 00		1.6079E 01	2.5208E 00	0.0
1.4100E 02	2.2361E 00		1.6079E 01	2.5202E 00	0.0
1.4400E 02	2.2358E 00		1.6078E 01	2.5195E 00	0.0
1.4700E 02	2.2355E 00		1.6077E 01	2.5186E 00	0.0
1.5000E 02	2.2352E 00		1.6076E 01	2.5177E 00	0.0

FIGURE 18c (1) BASAL TEST

MINIMUM 1.0500E 00 GC11L VERSUS TIME MAXIMUM 1.0829E 00

TIME	GC11L	I	GR22L2	GR22L3	GR22L4
0.0	1.0900E 00	*	3.9815E 01	7.1478E 00	2.7800E 00
3.0000E 00	1.0741E 00		2.5057E 01	7.6682E 00	2.7800E 00
6.0000E 00	1.0617E 00		1.6134E 01	7.3548E 00	2.7800E 00
9.0000E 00	1.0529E 00		1.1537E 01	7.1456E 00	2.7800E 00
1.2000E 01	1.0519E 00		9.0519E 00	7.0123E 00	2.7800E 00
1.5000E 01	1.0797E 00		7.6466E 00	6.9533E 00	2.7800E 00
1.8000E 01	1.0771E 00		6.8365E 00	6.8920E 00	2.7800E 00
2.1000E 01	1.0744E 00		6.3751E 00	6.8756E 00	2.7800E 00
2.4000E 01	1.0720E 00		6.1226E 00	6.8733E 00	2.7800E 00
2.7000E 01	1.0698E 00		5.9977E 00	6.8798E 00	2.7800E 00
3.0000E 01	1.0679E 00		5.9505E 00	6.8913E 00	2.7800E 00
3.3000E 01	1.0662E 00		5.9510E 00	6.9053E 00	2.7800E 00
3.6000E 01	1.0646E 00		5.9796E 00	6.9203E 00	2.7800E 00
3.9000E 01	1.0633E 00		6.0238E 00	6.9352E 00	2.7800E 00
4.2000E 01	1.0621E 00		6.0756E 00	6.9496E 00	2.7800E 00
4.5000E 01	1.0610E 00		6.1302E 00	6.9629E 00	2.7800E 00
4.8000E 01	1.0601E 00		6.1840E 00	6.9753E 00	2.7800E 00
5.1000E 01	1.0592E 00		6.2355E 00	6.9865E 00	2.7800E 00
5.4000E 01	1.0585E 00		6.2835E 00	6.9966E 00	2.7800E 00
5.7000E 01	1.0579E 00		6.3279E 00	7.0056E 00	2.7800E 00
6.0000E 01	1.0573E 00		6.3682E 00	7.0137E 00	2.7800E 00
6.3000E 01	1.0568E 00		6.4047E 00	7.0210E 00	2.7800E 00
6.6000E 01	1.0564E 00		6.4375E 00	7.0274E 00	2.7800E 00
6.9000E 01	1.0560E 00		6.4666E 00	7.0331E 00	2.7800E 00
7.2000E 01	1.0556E 00		6.4931E 00	7.0382E 00	2.7800E 00
7.5000E 01	1.0553E 00		6.5166E 00	7.0426E 00	2.7800E 00
7.8000E 01	1.0550E 00		6.5376E 00	7.0468E 00	2.7800E 00
8.1000E 01	1.0548E 00		6.5563E 00	7.0505E 00	2.7800E 00
8.4000E 01	1.0546E 00		6.5731E 00	7.0537E 00	2.7800E 00
8.7000E 01	1.0544E 00		6.5881E 00	7.0566E 00	2.7800E 00
9.0000E 01	1.0542E 00		6.6014E 00	7.0592E 00	2.7800E 00
9.3000E 01	1.0540E 00		6.6134E 00	7.0615E 00	2.7800E 00
9.6000E 01	1.0539E 00		6.6242E 00	7.0635E 00	2.7800E 00
9.9000E 01	1.0538E 00		6.6339E 00	7.0655E 00	2.7800E 00
1.0200E 02	1.0536E 00		6.6427E 00	7.0672E 00	2.7800E 00
1.0500E 02	1.0535E 00		6.6507E 00	7.0688E 00	2.7800E 00
1.0800E 02	1.0534E 00		6.6579E 00	7.0702E 00	2.7800E 00
1.1100E 02	1.0533E 00		6.6645E 00	7.0715E 00	2.7800E 00
1.1400E 02	1.0532E 00		6.6706E 00	7.0727E 00	2.7800E 00
1.1700E 02	1.0532E 00		6.6761E 00	7.0738E 00	2.7800E 00
1.2000E 02	1.0531E 00		6.6813E 00	7.0749E 00	2.7800E 00
1.2300E 02	1.0530E 00		6.6860E 00	7.0759E 00	2.7800E 00
1.2600E 02	1.0529E 00		6.6904E 00	7.0768E 00	2.7800E 00
1.2900E 02	1.0529E 00		6.6946E 00	7.0776E 00	2.7800E 00
1.3200E 02	1.0528E 00		6.6985E 00	7.0784E 00	2.7800E 00
1.3500E 02	1.0528E 00		6.7021E 00	7.0792E 00	2.7800E 00
1.3800E 02	1.0527E 00		6.7056E 00	7.0799E 00	2.7800E 00
1.4100E 02	1.0527E 00		6.7086E 00	7.0806E 00	2.7800E 00
1.4400E 02	1.0526E 00		6.7118E 00	7.0812E 00	2.7800E 00
1.4700E 02	1.0526E 00		6.7148E 00	7.0818E 00	2.7800E 00
1.5000E 02	1.0525E 00		6.7176E 00	7.0824E 00	2.7800E 00

FIGURE 18c (2) BASAL TEST

MINIMUM 4.7456E 00 — IC22P VERSUS TIME — MAXIMUM 5.1728E 00

TIME	IC22P	I	LIR	LAR	GCIP
0.0	4.7462E 00	+	1.4200E 02	1.6800E 01	1.0000E 00
3.0000E 00	6.0452E 00	----------	1.8084E 02	1.3610E 01	1.0736E 00
6.0000E 00	6.1607E 00	----------	1.8495E 02	1.3273E 01	1.0817E 00
9.0000E 00	6.1708E 00	----------	1.8561E 02	1.3219E 01	1.0829E 00
1.2000E 01	6.1763E 00	----------	1.8506E 02	1.3264E 01	1.0819E 00
1.5000E 01	6.1061E 00	----------	1.8394E 02	1.3355E 01	1.0797E 00
1.8000E 01	6.0586E 00	----------	1.8256E 02	1.3469E 01	1.0771E 00
2.1000E 01	6.0102E 00	----------	1.8113E 02	1.3586E 01	1.0744E 00
2.4000E 01	5.9675E 00	----------	1.7958E 02	1.3089E 01	1.0715E 00
2.7000E 01	5.9288E 00	----------	1.7874E 02	1.3783E 01	1.0698E 00
3.0000E 01	5.8946E 00	----------	1.7772E 02	1.3867E 01	1.0679E 00
3.3000E 01	5.8629E 00	----------	1.7680E 02	1.3942E 01	1.0662E 00
3.6000E 01	5.8353E 00	----------	1.7599E 02	1.4008E 01	1.0646E 00
3.9000E 01	5.8109E 00	----------	1.7528E 02	1.4067E 01	1.0633E 00
4.2000E 01	5.7894E 00	----------	1.7465E 02	1.4119E 01	1.0621E 00
4.5000E 01	5.7703E 00	----------	1.7409E 02	1.4164E 01	1.0610E 00
4.8000E 01	5.7535E 00	----------	1.7360E 02	1.4205E 01	1.0601E 00
5.1000E 01	5.7387E 00	----------	1.7317E 02	1.4240E 01	1.0593E 00
5.4000E 01	5.7257E 00	----------	1.7279E 02	1.4272E 01	1.0585E 00
5.7000E 01	5.7141E 00	----------	1.7245E 02	1.4299E 01	1.0579E 00
6.0000E 01	5.7039E 00	----------	1.7215E 02	1.4324E 01	1.0573E 00
6.3000E 01	5.6950E 00	----------	1.7189E 02	1.4345E 01	1.0568E 00
6.6000E 01	5.6870E 00	----------	1.7165E 02	1.4364E 01	1.0564E 00
6.9000E 01	5.6799E 00	----------	1.7145E 02	1.4382E 01	1.0560E 00
7.2000E 01	5.6736E 00	----------	1.7126E 02	1.4397E 01	1.0556E 00
7.5000E 01	5.6680E 00	----------	1.7110E 02	1.4410E 01	1.0553E 00
7.8000E 01	5.6630E 00	----------	1.7095E 02	1.4422E 01	1.0550E 00
8.1000E 01	5.6585E 00	----------	1.7082E 02	1.4433E 01	1.0548E 00
8.4000E 01	5.6546E 00	----------	1.7071E 02	1.4442E 01	1.0546E 00
8.7000E 01	5.6510E 00	----------	1.7060E 02	1.4451E 01	1.0544E 00
9.0000E 01	5.6478E 00	----------	1.7051E 02	1.4459E 01	1.0542E 00
9.3000E 01	5.6449E 00	----------	1.7042E 02	1.4466E 01	1.0540E 00
9.6000E 01	5.6423E 00	----------	1.7035E 02	1.4472E 01	1.0539E 00
9.9000E 01	5.6399E 00	----------	1.7028E 02	1.4478E 01	1.0538E 00
1.0200E 02	5.6377E 00	----------	1.7021E 02	1.4483E 01	1.0536E 00
1.0500E 02	5.6357E 00	----------	1.7015E 02	1.4488E 01	1.0535E 00
1.0800E 02	5.6339E 00	----------	1.7010E 02	1.4492E 01	1.0534E 00
1.1100E 02	5.6322E 00	----------	1.7005E 02	1.4496E 01	1.0533E 00
1.1400E 02	5.6307E 00	----------	1.7000E 02	1.4500E 01	1.0532E 00
1.1700E 02	5.6292E 00	----------	1.6996E 02	1.4504E 01	1.0532E 00
1.2000E 02	5.6279E 00	----------	1.6992E 02	1.4507E 01	1.0531E 00
1.2300E 02	5.6266E 00	----------	1.6988E 02	1.4510E 01	1.0530E 00
1.2600E 02	5.6254E 00	----------	1.6985E 02	1.4513E 01	1.0529E 00
1.2900E 02	5.6243E 00	----------	1.6981E 02	1.4516E 01	1.0529E 00
1.3200E 02	5.6232E 00	----------	1.6978E 02	1.4518E 01	1.0528E 00
1.3500E 02	5.6222E 00	----------	1.6975E 02	1.4521E 01	1.0528E 00
1.3800E 02	5.6212E 00	----------	1.6972E 02	1.4523E 01	1.0527E 00
1.4100E 02	5.6203E 00	----------	1.6970E 02	1.4525E 01	1.0527E 00
1.4400E 02	5.6194E 00	----------	1.6967E 02	1.4528E 01	1.0526E 00
1.4700E 02	5.6185E 00	----------	1.6964E 02	1.4530E 01	1.0526E 00
1.5000E 02	5.6177E 00	----------	1.6962E 02	1.4532E 01	1.0525E 00

FIGURE 18d (1) BASAL TEST

MINIMUM 4.4635E-01 AC22P VERSUS TIME MAXIMUM 5.6236E-01

TIME	AC22P	I	GCII	ICII	ACII
0.0	5.6236E-01	----------	1.0000E 00	5.0000E-01	6.0000E-02
3.0000E 00	4.7351E-01	----------	1.0716E 00	6.3438E-01	6.6647E-02
6.0000E 00	4.5575E-01	----+	1.0807E 00	6.2963E-01	5.9193E-02
9.0000E 00	4.4871E-01	-+	1.0826E 00	6.2065E-01	5.3721E-02
1.2000E 01	4.4645E-01	+	1.0816E 00	6.1273E-01	5.0026E-02
1.5000E 01	4.4668E-01	+	1.0798E 00	6.0585E-01	4.7641E-02
1.8000E 01	4.4866E-01	-+	1.0773E 00	5.9965E-01	4.6173E-02
2.1000E 01	4.5155E-01	--+	1.0746E 00	5.9390E-01	4.5326E-02
2.4000E 01	4.5421E-01	---+	1.0722E 00	5.8869E-01	4.4877E-02
2.7000E 01	4.5683E-01	----+	1.0700E 00	5.8399E-01	4.4680E-02
3.0000E 01	4.5931E-01	-----+	1.0680E 00	5.7975E-01	4.4640E-02
3.3000E 01	4.6161E-01	------+	1.0663E 00	5.7595E-01	4.4695E-02
3.6000E 01	4.6371E-01	-------+	1.0647E 00	5.7255E-01	4.4804E-02
3.9000E 01	4.6561E-01	--------+	1.0634E 00	5.6951E-01	4.4940E-02
4.2000E 01	4.6731E-01	---------+	1.0621E 00	5.6680E-01	4.5087E-02
4.5000E 01	4.6882E-01	---------+	1.0611E 00	5.6440E-01	4.5234E-02
4.8000E 01	4.7017E-01	----------+	1.0601E 00	5.6226E-01	4.5379E-02
5.1000E 01	4.7136E-01	----------+	1.0593E 00	5.6040E-01	4.5506E-02
5.4000E 01	4.7242E-01	----------+	1.0586E 00	5.5873E-01	4.5630E-02
5.7000E 01	4.7336E-01	----------+	1.0579E 00	5.5726E-01	4.5741E-02
6.0000E 02	4.7419E-01	----------+	1.0574E 00	5.5596E-01	4.5841E-02
6.3000E 01	4.7493E-01	----------+	1.0569E 00	5.5481E-01	4.5931E-02
6.6000E 01	4.7556E-01	----------+	1.0564E 00	5.5380E-01	4.6011E-02
6.9000E 01	4.7616E-01	----------+	1.0560E 00	5.5290E-01	4.6083E-02
7.2000E 01	4.7667E-01	----------+	1.0557E 00	5.5210E-01	4.6148E-02
7.5000E 01	4.7713E-01	----------+	1.0553E 00	5.5140E-01	4.6205E-02
7.8000E 01	4.7754E-01	----------+	1.0551E 00	5.5077E-01	4.6256E-02
8.1000E 01	4.7790E-01	----------+	1.0548E 00	5.5021E-01	4.6301E-02
8.4000E 01	4.7823E-01	----------+	1.0546E 00	5.4971E-01	4.6342E-02
8.7000E 01	4.7852E-01	----------+	1.0544E 00	5.4927E-01	4.6378E-02
9.0000E 01	4.7879E-01	----------+	1.0542E 00	5.4887E-01	4.6410E-02
9.3000E 01	4.7903E-01	----------+	1.0540E 00	5.4852E-01	4.6440E-02
9.6000E 01	4.7924E-01	----------+	1.0539E 00	5.4820E-01	4.6466E-02
9.9000E 01	4.7944E-01	----------+	1.0538E 00	5.4791E-01	4.6489E-02
1.0200E 02	4.7962E-01	----------+	1.0536E 00	5.4765E-01	4.6511E-02
1.0500E 02	4.7978E-01	----------+	1.0535E 00	5.4741E-01	4.6530E-02
1.0800E 02	4.7993E-01	----------+	1.0534E 00	5.4720E-01	4.6548E-02
1.1100E 02	4.8007E-01	----------+	1.0533E 00	5.4700E-01	4.6564E-02
1.1400E 02	4.8020E-01	----------+	1.0532E 00	5.4682E-01	4.6579E-02
1.1700E 02	4.8032E-01	----------+	1.0532E 00	5.4665E-01	4.6593E-02
1.2000E 02	4.8043E-01	----------+	1.0531E 00	5.4650E-01	4.6605E-02
1.2300E 02	4.8053E-01	----------+	1.0530E 00	5.4636E-01	4.6617E-02
1.2600E 02	4.8063E-01	----------+	1.0529E 00	5.4622E-01	4.6628E-02
1.2900E 02	4.8072E-01	----------+	1.0529E 00	5.4610E-01	4.6638E-02
1.3200E 02	4.8081E-01	----------+	1.0528E 00	5.4598E-01	4.6648E-02
1.3500E 02	4.8089E-01	----------+	1.0528E 00	5.4587E-01	4.6657E-02
1.3800E 02	4.8097E-01	----------+	1.0527E 00	5.4576E-01	4.6666E-02
1.4100E 02	4.8105E-01	----------+	1.0527E 00	5.4567E-01	4.6674E-02
1.4400E 02	4.8112E-01	----------+	1.0526E 00	5.4557E-01	4.6681E-02
1.4700E 02	4.8119E-01	----------+	1.0526E 00	5.4548E-01	4.6689E-02
1.5000E 02	4.8126E-01	----------+	1.0525E 00	5.4539E-01	4.6696E-02

FIGURE 18d (2) BASAL TEST

MINIMUM 1.7969E-01 — SEW3M VERSUS TIME — MAXIMUM 1.2907E 00

TIME	SEW3M	EW3M	GK23M	IC2M
0.0	1.2907E 00	0.0	1.2907E 00	5.0000E-01
3.0000E 00	4.6408E-01	2.1964E 00	4.5857E-01	3.3052E-01
6.0000E 00	3.2088E-01	3.3336E 00	3.1126E-01	2.8306E-01
9.0000E 00	2.7426E-01	4.2152E 00	2.6231E-01	2.6434E-01
1.2000E 01	2.5475E-01	5.0006E 00	2.4126E-01	2.5555E-01
1.5000E 01	2.4426E-01	5.7541E 00	2.2987E-01	2.5074E-01
1.8000E 01	2.3704E-01	6.4757E 00	2.2218E-01	2.4735E-01
2.1000E 01	2.3101E-01	7.1777E 00	2.1609E-01	2.4462E-01
2.4000E 01	2.2559E-01	7.8626E 00	2.1085E-01	2.4223E-01
2.7000E 01	2.2066E-01	8.5320E 00	2.0627E-01	2.4011E-01
3.0000E 01	2.1621E-01	9.1873E 00	2.0221E-01	2.3821E-01
3.3000E 01	2.1217E-01	9.8299E 00	1.9860E-01	2.3650E-01
3.6000E 01	2.0852E-01	1.0461E 01	1.9540E-01	2.3497E-01
3.9000E 01	2.0526E-01	1.1081E 01	1.9256E-01	2.3360E-01
4.2000E 01	2.0234E-01	1.1693E 01	1.9005E-01	2.3237E-01
4.5000E 01	1.9976E-01	1.2296E 01	1.8784E-01	2.3128E-01
4.8000E 01	1.9746E-01	1.2892E 01	1.8588E-01	2.3032E-01
5.1000E 01	1.9544E-01	1.3481E 01	1.8416E-01	2.2946E-01
5.4000E 01	1.9365E-01	1.4065E 01	1.8264E-01	2.2870E-01
5.7000E 01	1.9207E-01	1.4643E 01	1.8131E-01	2.2805E-01
6.0000E 01	1.9068E-01	1.5217E 01	1.8013E-01	2.2744E-01
6.3000E 01	1.8946E-01	1.5787E 01	1.7910E-01	2.2692E-01
6.6000E 01	1.8838E-01	1.6354E 01	1.7819E-01	2.2646E-01
6.9000E 01	1.8742E-01	1.6917E 01	1.7738E-01	2.2605E-01
7.2000E 01	1.8656E-01	1.7478E 01	1.7667E-01	2.2568E-01
7.5000E 01	1.8584E-01	1.8036E 01	1.7604E-01	2.2536E-01
7.8000E 01	1.8518E-01	1.8592E 01	1.7549E-01	2.2508E-01
8.1000E 01	1.8459E-01	1.9146E 01	1.7500E-01	2.2483E-01
8.4000E 01	1.8407E-01	1.9699E 01	1.7456E-01	2.2460E-01
8.7000E 01	1.8361E-01	2.0250E 01	1.7417E-01	2.2440E-01
9.0000E 01	1.8320E-01	2.0799E 01	1.7382E-01	2.2422E-01
9.3000E 01	1.8283E-01	2.1348E 01	1.7351E-01	2.2406E-01
9.6000E 01	1.8250E-01	2.1896E 01	1.7323E-01	2.2392E-01
9.9000E 01	1.8220E-01	2.2442E 01	1.7298E-01	2.2379E-01
1.0200E 02	1.8194E-01	2.2986E 01	1.7276E-01	2.2367E-01
1.0500E 02	1.8169E-01	2.3533E 01	1.7255E-01	2.2357E-01
1.0800E 02	1.8146E-01	2.4077E 01	1.7237E-01	2.2347E-01
1.1100E 02	1.8126E-01	2.4621E 01	1.7220E-01	2.2338E-01
1.1400E 02	1.8110E-01	2.5164E 01	1.7205E-01	2.2330E-01
1.1700E 02	1.8095E-01	2.5707E 01	1.7191E-01	2.2323E-01
1.2000E 02	1.8082E-01	2.6249E 01	1.7176E-01	2.2316E-01
1.2300E 02	1.8069E-01	2.6790E 01	1.7166E-01	2.2310E-01
1.2600E 02	1.8059E-01	2.7332E 01	1.7155E-01	2.2304E-01
1.2900E 02	1.8048E-01	2.7873E 01	1.7145E-01	2.2299E-01
1.3200E 02	1.8040E-01	2.8413E 01	1.7135E-01	2.2294E-01
1.3500E 02	1.8031E-01	2.8953E 01	1.7125E-01	2.2289E-01
1.3800E 02	1.8024E-01	2.9493E 01	1.7117E-01	2.2285E-01
1.4100E 02	1.7996E-01	3.0033E 01	1.7109E-01	2.2281E-01
1.4400E 02	1.7987E-01	3.0572E 01	1.7101E-01	2.2276E-01
1.4700E 02	1.7977E-01	3.1111E 01	1.7093E-01	2.2272E-01
1.5000E 02	1.7969E-01	3.1650E 01	1.7086E-01	2.2269E-01

FIGURE 18e (1) BASAL TEST

MINIMUM 9.9995E-01 GCIL VERSUS TIME MAXIMUM 1.0778E 00

TIME	GCIL	I	ICIL	ACIL
0.0	1.0000E 00	+	5.0000E-01	6.0000E-02
3.0000E 00	1.0088E 00	----------	9.2961E-01	8.8878E-02
6.0000E 00	1.0704E 00	----------	9.3344E-01	8.0931E-02
9.0000E 00	1.0778E 00	----------	9.2615E-01	7.5409E-02
1.2000E 01	1.0775E 00	----------	9.1756E-01	7.1816E-02
1.5000E 01	1.0750E 00	----------	9.0894E-01	6.9602E-02
1.8000E 01	1.0725E 00	----------	9.0050E-01	6.8334E-02
2.1000E 01	1.0700E 00	----------	8.9241E-01	6.7692E-02
2.4000E 01	1.0676E 00	----------	8.8513E-01	6.7420E-02
2.7000E 01	1.0656E 00	----------	8.7656E-01	6.7382E-02
3.0000E 01	1.0637E 00	----------	8.7263E-01	6.7484E-02
3.3000E 01	1.0620E 00	----------	8.6732E-01	6.7665E-02
3.6000E 01	1.0605E 00	----------	8.6256E-01	6.7885E-02
3.9000E 01	1.0592E 00	----------	8.5837E-01	6.8119E-02
4.2000E 01	1.0581E 00	----------	8.5462E-01	6.8352E-02
4.5000E 01	1.0570E 00	----------	8.5130E-01	6.8575E-02
4.8000E 01	1.0561E 00	----------	8.4836E-01	6.8783E-02
5.1000E 01	1.0553E 00	----------	8.4577E-01	6.8974E-02
5.4000E 01	1.0546E 00	----------	8.4348E-01	6.9148E-02
5.7000E 01	1.0540E 00	----------	8.4145E-01	6.9305E-02
6.0000E 01	1.0534E 00	----------	8.3966E-01	6.9445E-02
6.3000E 01	1.0529E 00	----------	8.3808E-01	6.9571E-02
6.6000E 01	1.0525E 00	----------	8.3668E-01	6.9683E-02
6.9000E 01	1.0521E 00	----------	8.3544E-01	6.9783E-02
7.2000E 01	1.0518E 00	----------	8.3434E-01	6.9872E-02
7.5000E 01	1.0515E 00	----------	8.3336E-01	6.9952E-02
7.8000E 01	1.0512E 00	----------	8.3250E-01	7.0022E-02
8.1000E 01	1.0510E 00	----------	8.3172E-01	7.0085E-02
8.4000E 01	1.0507E 00	----------	8.3103E-01	7.0142E-02
8.7000E 01	1.0505E 00	----------	8.3042E-01	7.0192E-02
9.0000E 01	1.0504E 00	----------	8.2987E-01	7.0237E-02
9.3000E 01	1.0502E 00	----------	8.2937E-01	7.0278E-02
9.6000E 01	1.0501E 00	----------	8.2892E-01	7.0315E-02
9.9000E 01	1.0499E 00	----------	8.2852E-01	7.0348E-02
1.0200E 02	1.0498E 00	----------	8.2815E-01	7.0376E-02
1.0500E 02	1.0497E 00	----------	8.2782E-01	7.0405E-02
1.0800E 02	1.0496E 00	----------	8.2751E-01	7.0430E-02
1.1100E 02	1.0495E 00	----------	8.2723E-01	7.0453E-02
1.1400E 02	1.0494E 00	----------	8.2698E-01	7.0474E-02
1.1700E 02	1.0493E 00	----------	8.2674E-01	7.0494E-02
1.2000E 02	1.0493E 00	----------	8.2652E-01	7.0512E-02
1.2300E 02	1.0492E 00	----------	8.2631E-01	7.0529E-02
1.2600E 02	1.0491E 00	----------	8.2612E-01	7.0545E-02
1.2900E 02	1.0491E 00	----------	8.2594E-01	7.0559E-02
1.3200E 02	1.0490E 00	----------	8.2577E-01	7.0573E-02
1.3500E 02	1.0490E 00	----------	8.2561E-01	7.0586E-02
1.3800E 02	1.0489E 00	----------	8.2546E-01	7.0599E-02
1.4100E 02	1.0488E 00	----------	8.2532E-01	7.0611E-02
1.4400E 02	1.0488E 00	----------	8.2518E-01	7.0622E-02
1.4700E 02	1.0487E 00	----------	8.2504E-01	7.0633E-02
1.5000E 02	1.0487E 00	----------	8.2491E-01	7.0644E-02

FIGURE 18e (2) BASAL TEST

MINIMUM 9.9999E-01 GC1M VERSUS TIME MAXIMUM 1.0710E 00

TIME	GC1M	I	IC1M	AC1M	GC2M
0.0	1.0000E 00	*	5.0000E-01	6.0000E-02	1.0000E 00
3.0000E 00	1.0333E 00	----------*	3.7891E-01	4.3018E-02	1.0120E 00
6.0000E 00	1.0467E 00	----------*	3.3315E-01	3.4072E-02	1.0309E 00
9.0000E 00	1.0565E 00	----------*	3.1439E-01	2.9132E-02	1.0455E 00
1.2000E 01	1.0649E 00	----------*	3.0533E-01	2.6188E-02	1.0558E 00
1.5000E 01	1.0686E 00	----------*	2.9997E-01	2.4372E-02	1.0627E 00
1.8000E 01	1.0705E 00	----------*	2.9613E-01	2.3252E-02	1.0668E 00
2.1000E 01	1.0710E 00	----------*	2.9294E-01	2.2579E-02	1.0691E 00
2.4000E 01	1.0707E 00	----------*	2.9015E-01	2.2195E-02	1.0699E 00
2.7000E 01	1.0700E 00	----------*	2.8766E-01	2.1994E-02	1.0695E 00
3.0000E 01	1.0689E 00	----------*	2.8543E-01	2.1906E-02	1.0683E 00
3.3000E 01	1.0677E 00	----------*	2.8342E-01	2.1895E-02	1.0668E 00
3.6000E 01	1.0664E 00	----------*	2.8162E-01	2.1925E-02	1.0671E 00
3.9000E 01	1.0651E 00	----------*	2.8001E-01	2.1978E-02	1.0659E 00
4.2000E 01	1.0639E 00	----------*	2.7858E-01	2.2044E-02	1.0647E 00
4.5000E 01	1.0627E 00	----------*	2.7730E-01	2.2114E-02	1.0635E 00
4.8000E 01	1.0616E 00	----------*	2.7617E-01	2.2184E-02	1.0623E 00
5.1000E 01	1.0606E 00	----------*	2.7517E-01	2.2251E-02	1.0613E 00
5.4000E 01	1.0597E 00	----------*	2.7428E-01	2.2314E-02	1.0605E 00
5.7000E 01	1.0589E 00	----------*	2.7349E-01	2.2372E-02	1.0594E 00
6.0000E 01	1.0582E 00	----------*	2.7280E-01	2.2424E-02	1.0586E 00
6.3000E 01	1.0576E 00	----------*	2.7219E-01	2.2472E-02	1.0579E 00
6.6000E 01	1.0570E 00	----------*	2.7164E-01	2.2514E-02	1.0572E 00
6.9000E 01	1.0565E 00	----------*	2.7116E-01	2.2552E-02	1.0566E 00
7.2000E 01	1.0560E 00	----------*	2.7074E-01	2.2586E-02	1.0561E 00
7.5000E 01	1.0556E 00	----------*	2.7036E-01	2.2617E-02	1.0556E 00
7.8000E 01	1.0552E 00	----------*	2.7003E-01	2.2644E-02	1.0552E 00
8.1000E 01	1.0549E 00	----------*	2.6973E-01	2.2668E-02	1.0548E 00
8.4000E 01	1.0546E 00	----------*	2.6947E-01	2.2689E-02	1.0545E 00
8.7000E 01	1.0543E 00	----------*	2.6924E-01	2.2708E-02	1.0542E 00
9.0000E 01	1.0541E 00	----------*	2.6904E-01	2.2726E-02	1.0539E 00
9.3000E 01	1.0539E 00	----------*	2.6884E-01	2.2741E-02	1.0537E 00
9.6000E 01	1.0537E 00	----------*	2.6867E-01	2.2755E-02	1.0535E 00
9.9000E 01	1.0535E 00	----------*	2.6852E-01	2.2767E-02	1.0533E 00
1.0200E 02	1.0534E 00	----------*	2.6836E-01	2.2776E-02	1.0531E 00
1.0500E 02	1.0532E 00	----------*	2.6825E-01	2.2789E-02	1.0530E 00
1.0800E 02	1.0531E 00	----------*	2.6814E-01	2.2798E-02	1.0528E 00
1.1100E 02	1.0530E 00	----------*	2.6804E-01	2.2806E-02	1.0527E 00
1.1400E 02	1.0529E 00	----------*	2.6795E-01	2.2814E-02	1.0526E 00
1.1700E 02	1.0528E 00	----------*	2.6786E-01	2.2821E-02	1.0525E 00
1.2000E 02	1.0527E 00	----------*	2.6778E-01	2.2826E-02	1.0524E 00
1.2300E 02	1.0526E 00	----------*	2.6771E-01	2.2834E-02	1.0523E 00
1.2600E 02	1.0525E 00	----------*	2.6764E-01	2.2839E-02	1.0522E 00
1.2900E 02	1.0524E 00	----------*	2.6757E-01	2.2845E-02	1.0521E 00
1.3200E 02	1.0524E 00	----------*	2.6751E-01	2.2850E-02	1.0520E 00
1.3500E 02	1.0523E 00	----------*	2.6746E-01	2.2854E-02	1.0520E 00
1.3800E 02	1.0522E 00	----------*	2.6740E-01	2.2859E-02	1.0519E 00
1.4100E 02	1.0522E 00	----------*	2.6735E-01	2.2863E-02	1.0518E 00
1.4400E 02	1.0521E 00	----------*	2.6731E-01	2.2867E-02	1.0518E 00
1.4700E 02	1.0521E 00	----------*	2.6726E-01	2.2870E-02	1.0517E 00
1.5000E 02	1.0520E 00	----------*	2.6721E-01	2.2874E-02	1.0517E 00

FIGURE 18f (1) BASAL TEST

MINIMUM -3.4425E 00 GRDELT VERSUS TIME MAXIMUM 4.0794E 01

TIME	GRDELT	I	GRIN	GROUT	GCIR
0.0	4.0794E 01	----------+	6.5961E 01	2.5187E 01	1.0000E 00
3.0000E 00	1.5457E 01	----------+	4.1755E 01	2.6298E 01	1.0788E 00
6.0000E 00	6.2960E 00	----------+	3.2519E 01	2.6223E 01	1.0835E 00
9.0000E 00	1.5603E 00	-----+	2.7712E 01	2.6152E 01	1.0834E 00
1.2000E 01	-9.9161E-01	--+	2.5094E 01	2.6086E 01	1.0818E 00
1.5000E 01	-2.4105E 00	-+	2.3610E 01	2.6020E 01	1.0795E 00
1.8000E 01	-3.1970E 00	+	2.2758E 01	2.5956E 01	1.0767E 00
2.1000E 01	-3.4425E 00	+	2.2450E 01	2.5893E 01	1.0740E 00
2.4000E 01	-3.3701E 00	+	2.2467E 01	2.5837E 01	1.0716E 00
2.7000E 01	-3.1945E 00	+	2.2593E 01	2.5787E 01	1.0695E 00
3.0000E 01	-2.9654E 00	+	2.2777E 01	2.5743E 01	1.0676E 00
3.3000E 01	-2.7141E 00	+	2.2989E 01	2.5703E 01	1.0659E 00
3.6000E 01	-2.4593E 00	-+	2.3209E 01	2.5668E 01	1.0644E 00
3.9000E 01	-2.2120E 00	-+	2.3425E 01	2.5637E 01	1.0630E 00
4.2000E 01	-1.9791E 00	-+	2.3630E 01	2.5610E 01	1.0619E 00
4.5000E 01	-1.7641E 00	-+	2.3821E 01	2.5586E 01	1.0608E 00
4.8000E 01	-1.5680E 00	--+	2.3996E 01	2.5564E 01	1.0599E 00
5.1000E 01	-1.3913E 00	--+	2.4155E 01	2.5546E 01	1.0591E 00
5.4000E 01	-1.2328E 00	--+	2.4297E 01	2.5530E 01	1.0584E 00
5.7000E 01	-1.0913E 00	--+	2.4424E 01	2.5516E 01	1.0578E 00
6.0000E 01	-9.6609E-01	--+	2.4537E 01	2.5503E 01	1.0572E 00
6.3000E 01	-8.5492E-01	--+	2.4637E 01	2.5492E 01	1.0567E 00
6.6000E 01	-7.5717E-01	---+	2.4726E 01	2.5483E 01	1.0563E 00
6.9000E 01	-6.7075E-01	---+	2.4804E 01	2.5474E 01	1.0559E 00
7.2000E 01	-5.9468E-01	---+	2.4872E 01	2.5467E 01	1.0556E 00
7.5000E 01	-5.2795E-01	---+	2.4933E 01	2.5461E 01	1.0553E 00
7.8000E 01	-4.6931E-01	---+	2.4986E 01	2.5455E 01	1.0550E 00
8.1000E 01	-4.1780E-01	---+	2.5032E 01	2.5450E 01	1.0548E 00
8.4000E 01	-3.7283E-01	---+	2.5073E 01	2.5446E 01	1.0545E 00
8.7000E 01	-3.3284E-01	---+	2.5109E 01	2.5442E 01	1.0543E 00
9.0000E 01	-2.9823E-01	---+	2.5140E 01	2.5439E 01	1.0542E 00
9.3000E 01	-2.6782E-01	---+	2.5168E 01	2.5436E 01	1.0540E 00
9.6000E 01	-2.4109E-01	---+	2.5192E 01	2.5433E 01	1.0539E 00
9.9000E 01	-2.1776E-01	---+	2.5213E 01	2.5431E 01	1.0537E 00
1.0200E 02	-1.9766E-01	---+	2.5232E 01	2.5429E 01	1.0536E 00
1.0500E 02	-1.7911E-01	---+	2.5248E 01	2.5427E 01	1.0535E 00
1.0800E 02	-1.6339E-01	---+	2.5262E 01	2.5425E 01	1.0534E 00
1.1100E 02	-1.4938E-01	---+	2.5275E 01	2.5424E 01	1.0533E 00
1.1400E 02	-1.3741E-01	---+	2.5285E 01	2.5423E 01	1.0532E 00
1.1700E 02	-1.2669E-01	---+	2.5295E 01	2.5422E 01	1.0531E 00
1.2000E 02	-1.1743E-01	---+	2.5303E 01	2.5421E 01	1.0531E 00
1.2300E 02	-1.0907E-01	---+	2.5311E 01	2.5420E 01	1.0530E 00
1.2600E 02	-1.0178E-01	---+	2.5317E 01	2.5419E 01	1.0529E 00
1.2900E 02	-9.5490E-02	---+	2.5323E 01	2.5418E 01	1.0529E 00
1.3200E 02	-8.9554E-02	---+	2.5328E 01	2.5418E 01	1.0528E 00
1.3500E 02	-8.4732E-02	---+	2.5332E 01	2.5417E 01	1.0528E 00
1.3800E 02	-8.0231E-02	---+	2.5336E 01	2.5417E 01	1.0527E 00
1.4100E 02	-7.6599E-02	---+	2.5339E 01	2.5416E 01	1.0526E 00
1.4400E 02	-7.3105E-02	---+	2.5343E 01	2.5416E 01	1.0526E 00
1.4700E 02	-7.0007E-02	---+	2.5345E 01	2.5415E 01	1.0525E 00
1.5000E 02	-6.7139E-02	---+	2.5348E 01	2.5415E 01	1.0525E 00

FIGURE 18f (2) BASAL TEST

MINIMUM 7.6037E 00 SEW3L VERSUS TIME MAXIMUM 2.4122E 02

TIME	SEW3L		EW3L	GR22L1	ILOAD
0.0	7.6037E 00	+	0.0	0.0	0.0
3.0000E 00	1.3269E 01	-+	3.7181E-02	0.0	0.0
6.0000E 00	1.3053E 01	-+	7.6775E-02	0.0	0.0
9.0000E 00	1.2669E 01	-+	1.1538E-01	0.0	0.0
1.2000E 01	1.2277E 01	-+	1.5280E-01	0.0	0.0
1.5000E 01	1.1993E 01	-+	1.8906E-01	0.0	0.0
1.8000E 01	1.1548E 01	+	2.2426E-01	0.0	0.0
2.1000E 01	1.1216E 01	+	2.5840E-01	0.0	0.0
2.4000E 01	1.0905E 01	-+	2.9158E-01	0.0	0.0
2.7000E 01	1.0619E 01	+	3.2386E-01	0.0	0.0
3.0000E 01	2.4122E 02	----------+	5.6982E-01	0.0	0.0
3.3000E 01	9.7218E 01	----------+	9.5216E-01	0.0	0.0
3.6000E 01	8.7875E 01	----------+	1.2271E 00	0.0	0.0
3.9000E 01	8.1329E 01	----------+	1.4858E 00	0.0	0.0
4.2000E 01	7.7525E 01	----------+	1.7199E 00	0.0	0.0
4.5000E 01	7.3552E 01	----------+	1.9465E 00	0.0	0.0
4.8000E 01	6.9845E 01	----------+	2.1616E 00	0.0	0.0
5.1000E 01	6.6345E 01	----------+	2.3660E 00	0.0	0.0
5.4000E 01	6.3033E 01	----------+	2.5601E 00	0.0	0.0
5.7000E 01	5.9899E 01	----------+	2.7445E 00	0.0	0.0
6.0000E 01	5.6937E 01	----------+	2.9198E 00	0.0	0.0
6.3000E 01	5.4145E 01	----------+	3.0864E 00	0.0	0.0
6.6000E 01	5.1510E 01	----------+	3.2449E 00	0.0	0.0
6.9000E 01	4.9025E 01	---------+	3.3957E 00	0.0	0.0
7.2000E 01	4.6681E 01	---------+	3.5393E 00	0.0	0.0
7.5000E 01	4.4466E 01	--------+	3.6761E 00	0.0	0.0
7.8000E 01	4.2378E 01	--------+	3.8063E 00	0.0	0.0
8.1000E 01	4.0402E 01	--------+	3.9305E 00	0.0	0.0
8.4000E 01	3.8532E 01	-------+	4.0489E 00	0.0	0.0
8.7000E 01	3.6760E 01	-------+	4.1618E 00	0.0	0.0
9.0000E 01	3.5079E 01	------+	4.2695E 00	0.0	0.0
9.3000E 01	3.3484E 01	------+	4.3722E 00	0.0	0.0
9.6000E 01	3.1967E 01	------+	4.4703E 00	0.0	0.0
9.9000E 01	3.0525E 01	----+	4.5639E 00	0.0	0.0
1.0200E 02	2.9152E 01	----+	4.6533E 00	0.0	0.0
1.0500E 02	2.7843E 01	----+	4.7387E 00	0.0	0.0
1.0800E 02	2.6596E 01	----+	4.8203E 00	0.0	0.0
1.1100E 02	2.5406E 01	---+	4.8982E 00	0.0	0.0
1.1400E 02	2.4269E 01	---+	4.9726E 00	0.0	0.0
1.1700E 02	2.3183E 01	---+	5.0437E 00	0.0	0.0
1.2000E 02	2.2146E 01	---+	5.1116E 00	0.0	0.0
1.2300E 02	2.1154E 01	--+	5.1764E 00	0.0	0.0
1.2600E 02	2.0210E 01	--+	5.2384E 00	0.0	0.0
1.2900E 02	1.9312E 01	--+	5.2975E 00	0.0	0.0
1.3200E 02	1.8456E 01	--+	5.3541E 00	0.0	0.0
1.3500E 02	1.7642E 01	--+	5.4081E 00	0.0	0.0
1.3800E 02	1.6867E 01	-+	5.4598E 00	0.0	0.0
1.4100E 02	1.6131E 01	-+	5.5092E 00	0.0	0.0
1.4400E 02	1.5432E 01	-+	5.5564E 00	0.0	0.0
1.4700E 02	1.4769E 01	-+	5.6016E 00	0.0	0.0
1.5000E 02	1.4142E 01	-+	5.6448E 00	0.0	0.0

FIGURE 19a (1) BASAL TEST (DYNAMIC EQUILIBRIUM)

MINIMUM 1.5059E-01 SEW3M VERSUS TIME MAXIMUM 3.7530E 01

TIME	SEW3M	EW3M	GK23M	IC2M
0.0	1.2907E 00	0.0	1.2907E 00	5.0000E-01
3.0000E 00	4.0104E-01	2.1932E 00	4.5614E-01	3.2982E-01
6.0000E 00	3.1200E-01	3.3153E 00	3.0393E-01	2.8038E-01
9.0000E 00	2.5716E-01	4.1576E 00	2.4806E-01	2.5851E-01
1.2000E 01	2.2836E-01	4.8831E 00	2.1924E-01	2.4604E-01
1.5000E 01	2.0862E-01	5.5377E 00	2.0000E-01	2.3717E-01
1.8000E 01	1.9272E-01	6.1594E 00	1.8497E-01	2.2987E-01
2.1000E 01	1.7897E-01	6.6968E 00	1.7225E-01	2.2341E-01
2.4000E 01	1.6675E-01	7.2154E 00	1.6112E-01	2.1752E-01
2.7000E 01	1.5560E-01	7.6991E 00	1.5123E-01	2.1207E-01
3.0000E 01	6.4759E-01	8.3318E 00	4.0602E-01	3.1482E-01
3.3000E 01	8.5360E 00	1.9599E 01	3.3228E 00	7.2985E-01
3.6000E 01	2.1668E 01	6.4310E 01	8.0007E 00	1.0373E 00
3.9000E 01	5.1727E 01	1.4542E 02	1.1681E 01	1.2088E 00
4.2000E 01	3.6006E 01	2.4900E 02	1.3685E 01	1.2657E 00
4.5000E 01	3.7456E 01	3.6086E 02	1.4350E 01	1.3103E 00
4.8000E 01	3.5856E 01	4.7130E 02	1.4137E 01	1.3025E 00
5.1000E 01	3.3023E 01	5.7489E 02	1.3415E 01	1.2755E 00
5.4000E 01	2.9750E 01	6.6916E 02	1.2439E 01	1.2375E 00
5.7000E 01	2.6396E 01	7.5340E 02	1.1370E 01	1.1938E 00
6.0000E 01	2.3256E 01	8.2708E 02	1.0301E 01	1.1476E 00
6.3000E 01	2.0402E 01	8.9335E 02	9.2854E 00	1.1009E 00
6.6000E 01	1.7865E 01	9.5073E 02	8.3469E 00	1.0555E 00
6.9000E 01	1.5640E 01	1.0010E 03	7.4950E 00	1.0105E 00
7.2000E 01	1.3732E 01	1.0449E 03	6.7294E 00	9.6792E-01
7.5000E 01	1.2026E 01	1.0835E 03	6.0466E 00	9.2736E-01
7.8000E 01	1.0562E 01	1.1174E 03	5.4389E 00	8.8887E-01
8.1000E 01	9.2987E 00	1.1471E 03	4.8985E 00	8.5244E-01
8.4000E 01	8.2025E 00	1.1734E 03	4.4181E 00	8.1795E-01
8.7000E 01	7.2485E 00	1.1965E 03	3.9904E 00	7.8532E-01
9.0000E 01	6.4176E 00	1.2170E 03	3.6092E 00	7.5446E-01
9.3000E 01	5.6919E 00	1.2352E 03	3.2687E 00	7.2508E-01
9.6000E 01	5.0565E 00	1.2513E 03	2.9640E 00	6.9724E-01
9.9000E 01	4.4968E 00	1.2656E 03	2.6906E 00	6.7078E-01
1.0200E 02	4.0081E 00	1.2783E 03	2.4450E 00	6.4557E-01
1.0500E 02	3.5755E 00	1.2897E 03	2.2237E 00	6.2154E-01
1.0800E 02	3.1931E 00	1.2998E 03	2.0241E 00	5.9859E-01
1.1100E 02	2.8546E 00	1.3039E 03	1.8436E 00	5.7664E-01
1.1400E 02	2.5542E 00	1.3170E 03	1.6802E 00	5.5563E-01
1.1700E 02	2.2873E 00	1.3243E 03	1.5321E 00	5.3548E-01
1.2000E 02	2.0497E 00	1.3308E 03	1.3975E 00	5.1615E-01
1.2300E 02	1.8379E 00	1.3366E 03	1.2752E 00	4.9758E-01
1.2600E 02	1.6496E 00	1.3418E 03	1.1639E 00	4.7973E-01
1.2900E 02	1.4808E 00	1.3465E 03	1.0627E 00	4.6260E-01
1.3200E 02	1.3304E 00	1.3507E 03	9.7083E-01	4.4616E-01
1.3500E 02	1.1965E 00	1.3545E 03	8.8729E-01	4.3039E-01
1.3800E 02	1.0770E 00	1.3579E 03	8.1134E-01	4.1526E-01
1.4100E 02	9.7024E-01	1.3610E 03	7.4230E-01	4.0074E-01
1.4400E 02	8.7494E-01	1.3637E 03	6.7954E-01	3.8683E-01
1.4700E 02	7.8984E-01	1.3662E 03	6.2252E-01	3.7351E-01
1.5000E 02	7.1387E-01	1.3684E 03	5.7074E-01	3.6075E-01

FIGURE 19a (2) BASAL TEST (DYNAMIC EQUILIBRIUM)

MINIMUM 3.4113E 00 SEW3L VERSUS TIME MAXIMUM 2.0739E 02

TIME	SEW3L	I	EW3L	GR22L1	ILOAD
0.0	3.4113E 00	+	1.0000E 01	0.0	0.0
3.0000E 00	6.7603E 00	+	1.0016E 01	0.0	0.0
6.0000E 00	6.7669E 00	+	1.0039E 01	0.0	0.0
9.0000E 00	6.6450E 00	+	1.0059E 01	0.0	0.0
1.2000E 01	6.5021E 00	+	1.0079E 01	0.0	0.0
1.5000E 01	6.3560E 00	+	1.0098E 01	0.0	0.0
1.8000E 01	6.2126E 00	+	1.0117E 01	0.0	0.0
2.1000E 01	6.0743E 00	+	1.0135E 01	0.0	0.0
2.4000E 01	5.9423E 00	+	1.0153E 01	0.0	0.0
2.7000E 01	5.8172E 00	+	1.0171E 01	0.0	0.0
3.0000E 01	2.0739E 02	----------	1.0372E 01	0.0	0.0
3.3000E 01	7.0727E 01	---------+	1.0684E 01	0.0	0.0
3.6000E 01	6.6858E 01	--------+	1.0900E 01	0.0	0.0
3.9000E 01	6.4547E 01	--------+	1.1100E 01	0.0	0.0
4.2000E 01	6.1086E 01	--------+	1.1289E 01	0.0	0.0
4.5000E 01	5.7973E 01	-------+	1.1467E 01	0.0	0.0
4.8000E 01	5.5063E 01	-------+	1.1637E 01	0.0	0.0
5.1000E 01	5.2311E 01	------+	1.1798E 01	0.0	0.0
5.4000E 01	4.9705E 01	------+	1.1951E 01	0.0	0.0
5.7000E 01	4.7235E 01	-----+	1.2096E 01	0.0	0.0
6.0000E 01	4.4864E 01	-----+	1.2234E 01	0.0	0.0
6.3000E 01	4.2708E 01	----+	1.2366E 01	0.0	0.0
6.6000E 01	4.0640E 01	----+	1.2491E 01	0.0	0.0
6.9000E 01	3.8694E 01	---+	1.2610E 01	0.0	0.0
7.2000E 01	3.6863E 01	---+	1.2723E 01	0.0	0.0
7.5000E 01	3.5139E 01	---+	1.2831E 01	0.0	0.0
7.8000E 01	3.3515E 01	---+	1.2934E 01	0.0	0.0
8.1000E 01	3.1993E 01	--+	1.3033E 01	0.0	0.0
8.4000E 01	3.0557E 01	--+	1.3126E 01	0.0	0.0
8.7000E 01	2.9199E 01	--+	1.3216E 01	0.0	0.0
9.0000E 01	2.7875E 01	--+	1.3301E 01	0.0	0.0
9.3000E 01	2.6646E 01	--+	1.3383E 01	0.0	0.0
9.6000E 01	2.5483E 01	--+	1.3461E 01	0.0	0.0
9.9000E 01	2.4377E 01	--+	1.3536E 01	0.0	0.0
1.0200E 02	2.3325E 01	--+	1.3608E 01	0.0	0.0
1.0500E 02	2.2324E 01	--+	1.3676E 01	0.0	0.0
1.0800E 02	2.1375E 01	--+	1.3742E 01	0.0	0.0
1.1100E 02	2.0468E 01	--+	1.3805E 01	0.0	0.0
1.1400E 02	1.9591E 01	--+	1.3865E 01	0.0	0.0
1.1700E 02	1.8762E 01	--+	1.3924E 01	0.0	0.0
1.2000E 02	1.7969E 01	--+	1.3977E 01	0.0	0.0
1.2300E 02	1.7210E 01	--+	1.4030E 01	0.0	0.0
1.2600E 02	1.6484E 01	--+	1.4081E 01	0.0	0.0
1.2900E 02	1.5789E 01	--+	1.4129E 01	0.0	0.0
1.3200E 02	1.5123E 01	--+	1.4175E 01	0.0	0.0
1.3500E 02	1.4485E 01	--+	1.4220E 01	0.0	0.0
1.3800E 02	1.3873E 01	--+	1.4262E 01	0.0	0.0
1.4100E 02	1.3285E 01	--+	1.4303E 01	0.0	0.0
1.4400E 02	1.2722E 01	--+	1.4341E 01	0.0	0.0
1.4700E 02	1.2181E 01	--+	1.4379E 01	0.0	0.0
1.5000E 02	1.1661E 01	--+	1.4414E 01	0.0	0.0

FIGURE 19b (1) BASAL TEST (DYNAMIC EQUILIBRIUM)

MINIMUM SEM3M VERSUS TIME MAXIMUM
1.8366E-01 4.2085E 01

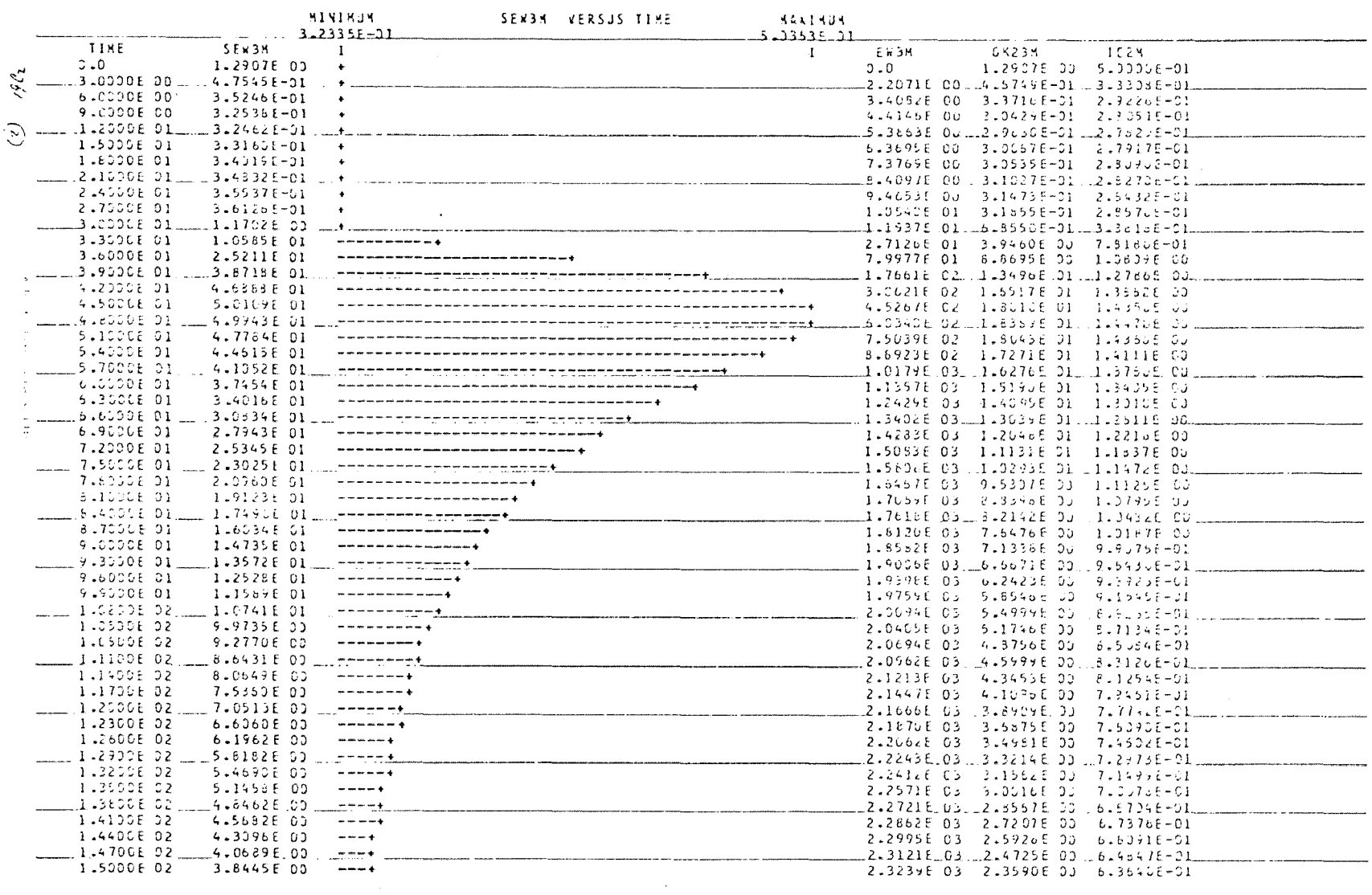
TIME	SEM3M	I	I	EM3M	GK23M	IC2M
0.0	1.2907E 00	-+		0.0	1.2907E 00	5.0000E-01
3.0000E 00	4.6174E-01	+		2.1936E 00	4.5668E-01	3.2997E-01
6.0000E 00	3.1612E-01	+		3.3203E 00	3.0731E-01	2.8162E-01
9.0000E 00	2.6635E-01	+		4.1842E 00	2.5575E-01	2.6167E-01
1.2000E 01	2.4325E-01	+		4.9457E 00	2.3171E-01	2.5154E-01
1.5000E 01	2.2907E-01	+		5.6532E 00	2.1721E-01	2.4513E-01
1.8000E 01	2.1826E-01	+		6.3239E 00	2.0655E-01	2.4024E-01
2.1000E 01	2.0894E-01	+		6.9647E 00	1.9768E-01	2.3606E-01
2.4000E 01	2.0044E-01	+		7.5787E 00	1.8984E-01	2.3227E-01
2.7000E 01	1.9253E-01	+		8.1682E 00	1.8271E-01	2.2874E-01
3.0000E 01	7.4976E-01	+		8.9405E 00	4.6258E-01	3.3167E-01
3.3000E 01	8.9686E 00	----------+		2.1045E 01	3.4606E 00	7.4181E-01
3.6000E 01	2.2699E 01	----------+		6.7785E 01	8.2675E 00	1.0510E 00
3.9000E 01	3.4090E 01	----------+		1.5395E 02	1.2524E 01	1.2329E 00
4.2000E 01	4.0247E 01	----------+		2.6657E 02	1.4724E 01	1.3239E 00
4.5000E 01	4.2076E 01	----------+		3.9089E 02	1.5728E 01	1.3595E 00
4.8000E 01	4.1132E 01	----------+		5.1624E 02	1.5771E 01	1.3608E 00
5.1000E 01	3.8067E 01	----------+		6.3629E 02	1.5227E 01	1.3418E 00
5.4000E 01	3.5615E 01	----------+		7.4769E 02	1.4362E 01	1.3107E 00
5.7000E 01	3.2172E 01	----------+		8.4930E 02	1.3349E 01	1.2730E 00
6.0000E 01	2.8915E 01	----------+		9.4097E 02	1.2298E 01	1.2319E 00
6.3000E 01	2.5878E 01	----------+		1.0232E 03	1.1271E 01	1.1896E 00
6.6000E 01	2.3120E 01	----------+		1.0966E 03	1.0301E 01	1.1476E 00
6.9000E 01	2.0553E 01	----------+		1.1623E 03	9.4046E 00	1.1066E 00
7.2000E 01	1.8265E 01	----------+		1.2209E 03	8.5670E 00	1.0670E 00
7.5000E 01	1.6253E 01	----------+		1.2734E 03	7.8469E 00	1.0292E 00
7.8000E 01	1.4532E 01	----------+		1.3204E 03	7.1797E 00	9.933CE-01
8.1000E 01	1.3334E 01	----------+		1.3627E 03	6.5794E 00	9.5920E-01
8.4000E 01	1.2613E 01	----------+		1.4007E 03	6.0393E 00	9.2690E-01
8.7000E 01	1.0847E 01	----------+		1.4350E 03	5.5531E 00	8.9630E-01
9.0000E 01	9.8147E 00	----------+		1.4659E 03	5.1148E 00	8.6729E-01
9.3000E 01	8.8991E 00	----------+		1.4940E 03	4.7188E 00	8.3978E-01
9.6000E 01	8.0547E 00	---------+		1.5195E 03	4.3603E 00	8.1356E-01
9.9000E 01	7.3583E 00	---------+		1.5426E 03	4.0350E 00	7.8881E-01
1.0200E 02	6.7CE7E 00	--------+		1.5637E 03	3.7390E 00	7.6514E-01
1.0500E 02	6.1263E 00	--------+		1.5830E 03	3.4693E 00	7.4256E-01
1.0800E 02	5.6028E 00	-------+		1.6005E 03	3.2228E 00	7.2094E-01
1.1100E 02	5.1311E 00	-------+		1.6166E 03	2.9970E 00	7.0035E-01
1.1400E 02	4.7053E 00	------+		1.6314E 03	2.7899E 00	6.8057E-01
1.1700E 02	4.3199E 00	------+		1.6449E 03	2.5995E 00	6.6160E-01
1.2000E 02	3.9705E 00	------+		1.6573E 03	2.4241E 00	6.4337E-01
1.2300E 02	3.6532E 00	-----+		1.6688E 03	2.2624E 00	6.2584E-01
1.2600E 02	3.3643E 00	----+		1.6793E 03	2.1129E 00	6.0895E-01
1.2900E 02	3.1011E 00	----+		1.6890E 03	1.9745E 00	5.9268E-01
1.3200E 02	2.8606E 00	----+		1.6979E 03	1.8463E 00	5.7697E-01
1.3500E 02	2.6410E 00	---+		1.7062E 03	1.7273E 00	5.6180E-01
1.3800E 02	2.4399E 00	---+		1.7138E 03	1.6168E 00	5.4714E-01
1.4100E 02	2.2555E 00	---+		1.7208E 03	1.5140E 00	5.3295E-01
1.4400E 02	2.0863E 00	---+		1.7273E 03	1.4183E 00	5.1921E-01
1.4700E 02	1.9308E 00	---+		1.7333E 03	1.3291E 00	5.0589E-01
1.5000E 02	1.7878E 00	--+		1.7389E 03	1.2459E 00	4.9297E-01

FIGURE 19b (2) BASAL TEST (DYNAMIC EQUILIBRIUM)

MINIMUM 0.0 SEWBL VERSUS TIME MAXIMUM 1.8037E 02

TIME	SEWBL	I	I	EWBL	GB22LI	ILOAD
0.0	0.0	+		1.9250E 01	2.1603E 01	0.0
3.0000E 00	1.0244E 00	+		1.9189E 01	1.7816E 01	0.0
6.0000E 00	1.2880E 00	+		1.9144E 01	1.4636E 01	0.0
9.0000E 00	1.4330E 00	+		1.9106E 01	1.2956E 01	0.0
1.2000E 01	1.5334E 00	+		1.9074E 01	1.1730E 01	0.0
1.5000E 01	1.6067E 00	+		1.9045E 01	1.0850E 01	0.0
1.8000E 01	1.6684E 00	+		1.9018E 01	1.0220E 01	0.0
2.1000E 01	1.7175E 00	+		1.8993E 01	9.7566E 00	0.0
2.4000E 01	1.7591E 00	+		1.8970E 01	9.4072E 00	0.0
2.7000E 01	1.7952E 00	+		1.8947E 01	9.1356E 00	0.0
3.0000E 01	1.8067E 02	----------+		1.9099E 01	0.0	0.0
3.3000E 01	5.9691E 01	----------+		1.9351E 01	0.0	0.0
3.6000E 01	5.3203E 01	----------+		1.9519E 01	0.0	0.0
3.9000E 01	4.9772E 01	----------+		1.9673E 01	0.0	0.0
4.2000E 01	4.6969E 01	----------+		1.9816E 01	0.0	0.0
4.5000E 01	4.4475E 01	----------+		1.9955E 01	0.0	0.0
4.8000E 01	4.2114E 01	----------+		2.0085E 01	0.0	0.0
5.1000E 01	3.9868E 01	----------+		2.0208E 01	0.0	0.0
5.4000E 01	3.7734E 01	----------+		2.0325E 01	0.0	0.0
5.7000E 01	3.5712E 01	---------+		2.0435E 01	0.0	0.0
6.0000E 01	3.3805E 01	---------+		2.0539E 01	0.0	0.0
6.3000E 01	3.2012E 01	---------+		2.0636E 01	0.0	0.0
6.6000E 01	3.0329E 01	---------+		2.0721E 01	0.0	0.0
6.9000E 01	2.8752E 01	--------+		2.0820E 01	0.0	0.0
7.2000E 01	2.7274E 01	--------+		2.0904E 01	0.0	0.0
7.5000E 01	2.5890E 01	--------+		2.0954E 01	0.0	0.0
7.8000E 01	2.4591E 01	-------+		2.1060E 01	0.0	0.0
8.1000E 01	2.3372E 01	-------+		2.1132E 01	0.0	0.0
8.4000E 01	2.2227E 01	-------+		2.1200E 01	0.0	0.0
8.7000E 01	2.1149E 01	------+		2.1265E 01	0.0	0.0
9.0000E 01	2.0132E 01	------+		2.1327E 01	0.0	0.0
9.3000E 01	1.9173E 01	------+		2.1386E 01	0.0	0.0
9.6000E 01	1.8266E 01	------+		2.1442E 01	0.0	0.0
9.9000E 01	1.7408E 01	-----+		2.1495E 01	0.0	0.0
1.0200E 02	1.6594E 01	-----+		2.1547E 01	0.0	0.0
1.0500E 02	1.5821E 01	-----+		2.1595E 01	0.0	0.0
1.0800E 02	1.5087E 01	-----+		2.1642E 01	0.0	0.0
1.1100E 02	1.4389E 01	----+		2.1686E 01	0.0	0.0
1.1400E 02	1.3724E 01	----+		2.1728E 01	0.0	0.0
1.1700E 02	1.3089E 01	----+		2.1768E 01	0.0	0.0
1.2000E 02	1.2484E 01	----+		2.1807E 01	1.2584E-05	0.0
1.2300E 02	1.1907E 01	----+		2.1843E 01	5.2577E-05	0.0
1.2600E 02	1.1354E 01	----+		2.1878E 01	9.0981E-05	0.0
1.2900E 02	1.0826E 01	---+		2.1911E 01	1.2790E-04	0.0
1.3200E 02	1.0320E 01	---+		2.1945E 01	1.6343E-04	0.0
1.3500E 02	9.8362E 00	---+		2.1973E 01	1.9757E-04	0.0
1.3800E 02	9.3721E 00	---+		2.2002E 01	2.3071E-04	0.0
1.4100E 02	8.9270E 00	---+		2.2029E 01	2.6259E-04	0.0
1.4400E 02	8.5000E 00	---+		2.2056E 01	2.9342E-04	0.0
1.4700E 02	8.0902E 00	---+		2.2081E 01	3.2324E-04	0.0
1.5000E 02	7.6965E 00	---+		2.2104E 01	3.5212E-04	0.0

FIGURE 19c (1) BASAL TEST (DYNAMIC EQUILIBRIUM)



TIME	SEM3M	I	EM3M	GK23M	IC2M
0.0	1.2907E 00	+	0.0	1.2907E 00	5.0000E-01
3.0000E 00	4.7545E-01	+	2.2071E 00	4.5749E-01	3.3308E-01
6.0000E 00	3.5246E-01	+	3.4052E 00	3.8716E-01	2.9226E-01
9.0000E 00	3.2536E-01	+	4.4146E 00	3.0424E-01	2.9351E-01
1.2000E 01	3.2462E-01	+	5.3883E 00	2.9650E-01	2.7822E-01
1.5000E 01	3.3165E-01	+	6.3695E 00	3.0667E-01	2.7917E-01
1.8000E 01	3.4019E-01	+	7.3769E 00	3.0535E-01	2.8049E-01
2.1000E 01	3.4832E-01	+	8.4097E 00	3.1027E-01	2.8270E-01
2.4000E 01	3.5537E-01	+	9.4653E 00	3.1473E-01	2.8432E-01
2.7000E 01	3.6126E-01	+	1.0540E 01	3.1855E-01	2.8570E-01
3.0000E 01	1.1702E 00	+	1.1937E 01	6.8550E-01	3.3616E-01
3.3000E 01	1.0585E 01	----------+	2.7126E 01	3.9460E 00	7.8160E-01
3.6000E 01	2.5211E 01	----------+	7.9977E 01	6.6695E 00	1.0809E 00
3.9000E 01	3.8718E 01	----------+	1.7661E 02	1.3490E 01	1.2786E 00
4.2000E 01	4.6888E 01	----------+	3.0621E 02	1.6917E 01	1.3562E 00
4.5000E 01	5.0109E 01	----------+	4.5267E 02	1.8013E 01	1.4356E 00
4.8000E 01	4.9943E 01	----------+	6.0340E 02	1.8356E 01	1.4476E 00
5.1000E 01	4.7764E 01	----------+	7.5039E 02	1.8046E 01	1.4356E 00
5.4000E 01	4.4615E 01	----------+	8.9923E 02	1.7271E 01	1.4111E 00
5.7000E 01	4.1052E 01	----------+	1.0179E 03	1.6276E 01	1.3796E 00
6.0000E 01	3.7454E 01	----------+	1.1357E 03	1.5190E 01	1.3439E 00
6.3000E 01	3.4016E 01	----------+	1.2429E 03	1.4089E 01	1.3110E 00
6.6000E 01	3.0834E 01	----------+	1.3402E 03	1.3039E 01	1.2811E 00
6.9000E 01	2.7943E 01	----------+	1.4283E 03	1.2046E 01	1.2210E 00
7.2000E 01	2.5345E 01	----------+	1.5083E 03	1.1131E 01	1.1837E 00
7.5000E 01	2.3025E 01	----------+	1.5806E 03	1.0293E 01	1.1472E 00
7.8000E 01	2.0960E 01	----------+	1.6457E 03	9.5307E 00	1.1125E 00
8.1000E 01	1.9123E 01	----------+	1.7056E 03	8.8548E 00	1.0795E 00
8.4000E 01	1.7490E 01	----------+	1.7618E 03	8.2142E 00	1.0482E 00
8.7000E 01	1.6034E 01	----------+	1.8120E 03	7.6476E 00	1.0187E 00
9.0000E 01	1.4735E 01	----------+	1.8552E 03	7.1336E 00	9.9075E-01
9.3000E 01	1.3572E 01	----------+	1.9006E 03	6.6671E 00	9.6439E-01
9.6000E 01	1.2528E 01	----------+	1.9398E 03	6.2423E 00	9.3923E-01
9.9000E 01	1.1589E 01	----------+	1.9759E 03	5.8546E 00	9.1545E-01
1.0200E 02	1.0741E 01	----------+	2.0094E 03	5.4994E 00	8.9305E-01
1.0500E 02	9.9735E 00	----------+	2.0405E 03	5.1746E 00	8.7194E-01
1.0800E 02	9.2770E 00	---------+	2.0694E 03	4.8756E 00	8.5084E-01
1.1100E 02	8.6431E 00	---------+	2.0962E 03	4.5999E 00	8.3120E-01
1.1400E 02	8.0649E 00	--------+	2.1213E 03	4.3453E 00	8.1254E-01
1.1700E 02	7.5360E 00	--------+	2.1447E 03	4.1079E 00	7.9451E-01
1.2000E 02	7.0513E 00	-------+	2.1666E 03	3.8904E 00	7.7744E-01
1.2300E 02	6.6060E 00	-------+	2.1870E 03	3.6875E 00	7.6093E-01
1.2600E 02	6.1962E 00	------+	2.2066E 03	3.4981E 00	7.4502E-01
1.2900E 02	5.8182E 00	------+	2.2243E 03	3.3214E 00	7.2973E-01
1.3200E 02	5.4690E 00	------+	2.2416E 03	3.1562E 00	7.1497E-01
1.3500E 02	5.1458E 00	-----+	2.2571E 03	3.0016E 00	7.0078E-01
1.3800E 02	4.8462E 00	-----+	2.2721E 03	2.8567E 00	6.8704E-01
1.4100E 02	4.5682E 00	-----+	2.2862E 03	2.7207E 00	6.7376E-01
1.4400E 02	4.3096E 00	----+	2.2995E 03	2.5926E 00	6.6091E-01
1.4700E 02	4.0689E 00	----+	2.3121E 03	2.4725E 00	6.4847E-01
1.5000E 02	3.8445E 00	----+	2.3239E 03	2.3590E 00	6.3640E-01

FIGURE 19c (2) BASAL TEST (DYNAMIC EQUILIBRIUM)

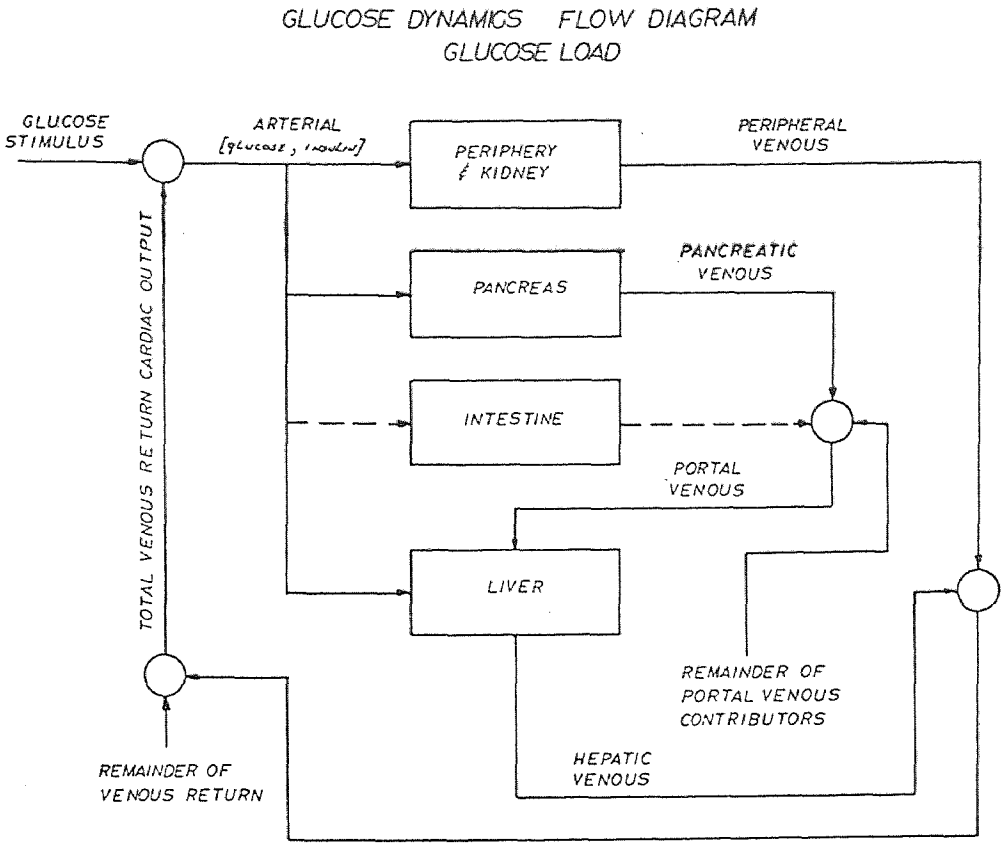


FIGURE 20a*

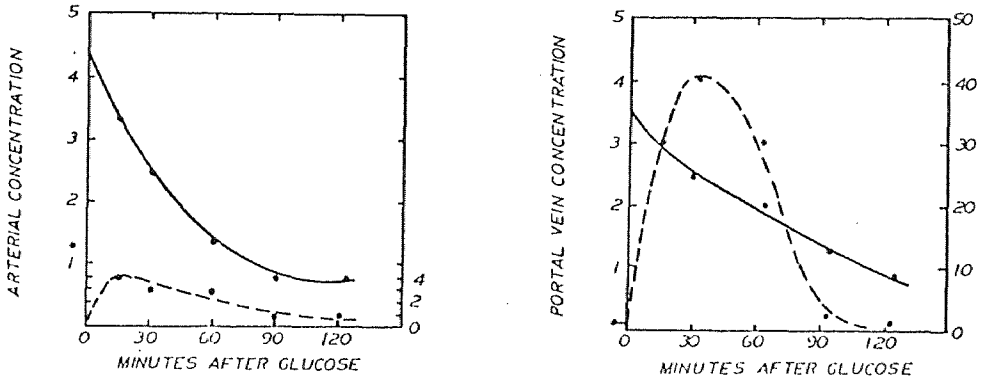


FIGURE 20b*

*In Vivo Test Data, Finkelstein (27).

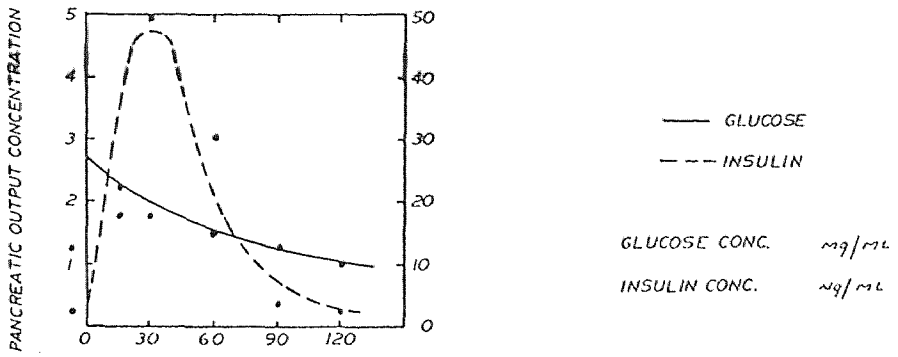


Figure 20c*

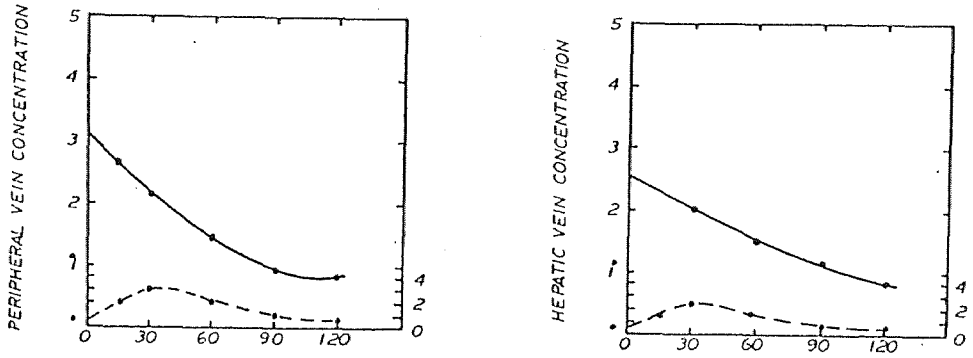


Figure 20d*

*In Vivo Test Data, Finkelstein (27).

TIME	GC1C	MINIMUM 9.6779E-01 — GC1C VERSUS TIME — MAXIMUM 8.4289E 00	IC1C	AC1C	GRIC*
0.0	1.0000E 00	+	5.0000E-01	6.0000E-02	0.0
3.0000E 00	1.0483E 00	+	6.2441E-01	6.5755E-02	9.2828E 00
6.0000E 00	1.0346E 00	+	6.0757E-01	5.7914E-02	1.5248E 01
9.0000E 00	1.0208E 00	+	5.9156E-01	5.2636E-02	1.9662E 01
1.2000E 01	1.0088E 00	+	5.7859E-01	4.9259E-02	2.2832E 01
1.5000E 01	9.9873E-01	+	5.6766E-01	4.7194E-02	2.5110E 01
1.8000E 01	9.9099E-01	+	5.5804E-01	4.6016E-02	2.6753E 01
2.1000E 01	9.8262E-01	+	5.4927E-01	4.5434E-02	2.7942E 01
2.4000E 01	9.7612E-01	+	5.4114E-01	4.5236E-02	2.8807E 01
2.7000E 01	9.7040E-01	+	5.3352E-01	4.5292E-02	2.9440E 01
3.0000E 01	8.4289E 00	----------	1.6759E 00	3.0452E-02	-9.8786E 02
3.3000E 01	3.1475E 00	----------+	2.5374E 00	1.9261E-02	3.6701E 01
3.6000E 01	2.8906E 00	----------+	2.9668E 00	1.2714E-02	3.7993E 01
3.9000E 01	2.7885E 00	----------+	3.1493E 00	8.4097E-03	3.2768E 01
4.2000E 01	2.7018E 00	----------+	3.2169E 00	5.5661E-03	2.8956E 01
4.5000E 01	2.6195E 00	----------+	3.2122E 00	-3.6849E-03	2.6396E 01
4.8000E 01	2.5413E 00	----------+	3.1627E 00	2.4394E-03	2.4731E 01
5.1000E 01	2.4641E 00	----------+	3.0862E 00	1.6156E-03	2.3707E 01
5.4000E 01	2.3914E 00	----------+	2.9945E 00	1.0702E-03	2.3144E 01
5.7000E 01	2.3225E 00	----------+	2.8953E 00	7.0900E-04	2.2912E 01
6.0000E 01	2.2573E 00	---------+	2.7935E 00	4.6987E-04	2.2909E 01
6.3000E 01	2.1960E 00	---------+	2.6923E 00	3.1156E-04	2.3063E 01
6.6000E 01	2.1382E 00	---------+	2.5936E 00	2.0678E-04	2.3321E 01
6.9000E 01	2.0839E 00	---------+	2.4989E 00	1.3741E-04	2.3637E 01
7.2000E 01	2.0326E 00	---------+	2.4084E 00	9.1475E-05	2.3986E 01
7.5000E 01	1.9847E 00	-------+	2.3223E 00	6.1080E-05	2.4352E 01
7.8000E 01	1.9392E 00	-------+	2.2408E 00	4.0971E-05	2.4714E 01
8.1000E 01	1.8984E 00	-------+	2.1636E 00	2.7701E-05	2.5066E 01
8.4000E 01	1.8558E 00	------+	2.0905E 00	1.8669E-05	2.5405E 01
8.7000E 01	1.8175E 00	------+	2.0213E 00	1.3065E-05	2.5723E 01
9.0000E 01	1.7807E 00	------+	1.9557E 00	9.2089E-06	2.6022E 01
9.3000E 01	1.7456E 00	------+	1.8935E 00	6.6794E-06	2.6302E 01
9.6000E 01	1.7126E 00	-----+	1.8343E 00	4.9807E-06	2.6560E 01
9.9000E 01	1.6806E 00	-----+	1.7779E 00	3.9004E-06	2.6802E 01
1.0200E 02	1.6505E 00	-----+	1.7242E 00	3.1553E-06	2.7024E 01
1.0500E 02	1.6214E 00	-----+	1.6728E 00	2.8647E-06	2.7231E 01
1.0800E 02	1.5935E 00	-----+	1.6237E 00	2.8236E-06	2.7423E 01
1.1100E 02	1.5666E 00	-----+	1.5767E 00	2.8238E-06	2.7602E 01
1.1400E 02	1.5410E 00	----+	1.5316E 00	2.8238E-06	2.7767E 01
1.1700E 02	1.5162E 00	----+	1.4885E 00	2.8238E-06	2.7921E 01
1.2000E 02	1.4923E 00	----+	1.4466E 00	2.8238E-06	2.8066E 01
1.2300E 02	1.4692E 00	----+	1.4065E 00	2.8238E-06	2.8200E 01
1.2600E 02	1.4479E 00	----+	1.3678E 00	2.8238E-06	2.8326E 01
1.2900E 02	1.4254E 00	----+	1.3305E 00	2.8238E-06	2.8443E 01
1.3200E 02	1.4046E 00	---+	1.2945E 00	2.8238E-06	2.8554E 01
1.3500E 02	1.3845E 00	---+	1.2597E 00	2.8238E-06	2.8659E 01
1.3800E 02	1.3649E 00	---+	1.2260E 00	2.8238E-06	2.8757E 01
1.4100E 02	1.3460E 00	---+	1.1935E 00	2.8238E-06	2.8850E 01
1.4400E 02	1.3276E 00	---+	1.1619E 00	2.8238E-06	2.8938E 01
1.4700E 02	1.3096E 00	---+	1.1313E 00	2.8238E-06	2.9021E 01
1.5000E 02	1.2926E 00	---+	1.1016E 00	6.7699E-04	2.9106E 01

FIGURE 21a (1) GLUCOSE LOAD TEST

*To correct, multiply by HK, (0.727)

(5) 2/4L

MINIMUM 1.0000E 00 — GCIS VERSUS TIME — MAXIMUM 9.6347E 00

TIME	GCIS	I	ACIS	AAN	GCIVC
0.0	1.0000E 00	+	6.0000E-02	1.5359E 00	1.0376E 00
3.0000E 00	1.0738E 00	+	6.6892E-02	1.2987E 00	1.0850E 00
6.0000E 00	1.0752E 00	+	5.8947E-02	1.1187E 00	1.0360E 00
9.0000E 00	1.0729E 00	+	5.3684E-02	1.0028E 00	1.0842E 00
1.2000E 01	1.0694E 00	+	5.0343E-02	9.2903E-01	1.0616E 00
1.5000E 01	1.0653E 00	+	4.8315E-02	8.8284E-01	1.0783E 00
1.8000E 01	1.0615E 00	+	4.7171E-02	8.5517E-01	1.0748E 00
2.1000E 01	1.0587E 00	+	4.6614E-02	8.3997E-01	1.0710E 00
2.4000E 01	1.0525E 00	+	4.6441E-02	8.3310E-01	1.0673E 00
2.7000E 01	1.0485E 00	+	4.6515E-02	8.3170E-01	1.0636E 00
3.0000E 01	5.8066E 00	----------+	3.0112E-02	6.7488E-01	6.9421E 00
3.3000E 01	3.2446E 00	----------+	1.9050E-02	3.6628E-01	3.2095E 00
3.6000E 01	2.9914E 00	----------+	1.2579E-02	2.1655E-01	2.9758E 00
3.9000E 01	2.8754E 00	----------+	8.3223E-03	1.3909E-01	2.8626E 00
4.2000E 01	2.7786E 00	----------+	5.5088E-03	9.1751E-02	2.7671E 00
4.5000E 01	2.6896E 00	----------+	3.6472E-03	6.1035E-02	2.6787E 00
4.8000E 01	2.6059E 00	---------+	2.4150E-03	4.0741E-02	2.5957E 00
5.1000E 01	2.5270E 00	---------+	1.5993E-03	2.7255E-02	2.5178E 00
5.4000E 01	2.4528E 00	---------+	1.0593E-03	1.8268E-02	2.4446E 00
5.7000E 01	2.3833E 00	---------+	7.0179E-04	1.2269E-02	2.3762E 00
6.0000E 01	2.3181E 00	--------+	4.6510E-04	8.2572E-03	2.3123E 00
6.3000E 01	2.2571E 00	--------+	3.0841E-04	5.5676E-03	2.2526E 00
6.6000E 01	2.2001E 00	-------+	2.0466E-04	3.7625E-03	2.1968E 00
6.9000E 01	2.1466E 00	-------+	1.3600E-04	2.5477E-03	2.1446E 00
7.2000E 01	2.0965E 00	-------+	9.0547E-05	1.7306E-03	2.0955E 00
7.5000E 01	2.0493E 00	-------+	6.0465E-05	1.1792E-03	2.0494E 00
7.8000E 01	2.0049E 00	------+	4.0568E-05	8.0965E-04	2.0059E 00
8.1000E 01	1.9633E 00	------+	2.7365E-05	5.5780E-04	1.9649E 00
8.4000E 01	1.9242E 00	------+	1.8697E-05	3.8900E-04	1.9260E 00
8.7000E 01	1.8875E 00	------+	1.2923E-05	2.7490E-04	1.8891E 00
9.0000E 01	1.8497E 00	-----+	9.0972E-06	1.9621E-04	1.8540E 00
9.3000E 01	1.8156E 00	-----+	6.6347E-06	1.4546E-04	1.8205E 00
9.6000E 01	1.7831E 00	-----+	4.9360E-06	1.1050E-04	1.7886E 00
9.9000E 01	1.7520E 00	-----+	3.8520E-06	8.8284E-05	1.7580E 00
1.0200E 02	1.7222E 00	-----+	3.1181E-06	7.3400E-05	1.7287E 00
1.0500E 02	1.6937E 00	-----+	2.8461E-06	6.8327E-05	1.7007E 00
1.0800E 02	1.6663E 00	----+	2.7828E-06	6.9343E-05	1.6737E 00
1.1100E 02	1.6405E 00	---+	2.7828E-06	7.0331E-05	1.6478E 00
1.1400E 02	1.6146E 00	---+	2.7828E-06	7.1289E-05	1.6229E 00
1.1700E 02	1.5903E 00	----+	2.7828E-06	7.2218E-05	1.5988E 00
1.2000E 02	1.5667E 00	---+	2.7828E-06	7.3117E-05	1.5756E 00
1.2300E 02	1.5440E 00	---+	2.7828E-06	7.3987E-05	1.5532E 00
1.2600E 02	1.5221E 00	----+	2.7828E-06	7.4828E-05	1.5316E 00
1.2900E 02	1.5009E 00	--+	2.7828E-06	7.5641E-05	1.5106E 00
1.3200E 02	1.4804E 00	--+	2.7828E-06	7.6425E-05	1.4904E 00
1.3500E 02	1.4605E 00	----+	2.7828E-06	7.7182E-05	1.4707E 00
1.3800E 02	1.4412E 00	--+	2.7828E-06	7.7911E-05	1.4517E 00
1.4100E 02	1.4225E 00	--+	2.7828E-06	7.8615E-05	1.4332E 00
1.4400E 02	1.4044E 00	--+	2.7828E-06	7.9293E-05	1.4153E 00
1.4700E 02	1.3868E 00	--+	2.7828E-06	7.9945E-05	1.3979E 00
1.5000E 02	1.3698E 00	--+	7.5252E-04	5.9827E-03	1.3811E 00

FIGURE 21a (2) GLUCOSE LOAD TEST

MINIMUM 1.0735E 00 — GC22L VERSUS TIME — MAXIMUM 7.3555E 00

TIME	GC22L	I	GC11F	IC11F	AC11F
0.0	1.1158E 00	+	1.0315E 00	5.0000E-01	6.0000E-02
3.0000E 00	1.1375E 00	+	1.0787E 00	6.6684E-01	6.8447E-02
6.0000E 00	1.1214E 00	+	1.0772E 00	6.4759E-01	6.0469E-02
9.0000E 00	1.1091E 00	+	1.0733E 00	6.3095E-01	5.5321E-02
1.2000E 01	1.1054E 00	+	1.0690E 00	6.1762E-01	5.2096E-02
1.5000E 01	1.0936E 00	+	1.0646E 00	6.0632E-01	5.0156E-02
1.8000E 01	1.0860E 00	+	1.0602E 00	5.9627E-01	4.9101E-02
2.1000E 01	1.0832E 00	+	1.0556E 00	5.8707E-01	4.8604E-02
2.4000E 01	1.0796E 00	+	1.0516E 00	5.7849E-01	4.8480E-02
2.7000E 01	1.0752E 00	+	1.0476E 00	5.7043E-01	4.8592E-02
3.0000E 01	7.9535E 00	----------+	7.1984E 00	2.0833E 00	2.8945E-02
3.3000E 01	3.1987E 00	----------+	3.1988E 00	2.8912E 00	1.8449E-02
3.6000E 01	2.9125E 00	----------+	2.9611E 00	3.2669E 00	1.2190E-02
3.9000E 01	2.7811E 00	----------+	2.8500E 00	3.4178E 00	8.0666E-03
4.2000E 01	2.6801E 00	----------+	2.7558E 00	3.4639E 00	5.3402E-03
4.5000E 01	2.5921E 00	----------+	2.6685E 00	3.4427E 00	3.5358E-03
4.8000E 01	2.5115E 00	----------+	2.5862E 00	3.3797E 00	2.3415E-03
5.1000E 01	2.4372E 00	----------+	2.5085E 00	3.2917E 00	1.5506E-03
5.4000E 01	2.3675E 00	----------+	2.4355E 00	3.1901E 00	1.0270E-03
5.7000E 01	2.3025E 00	---------+	2.3670E 00	3.0820E 00	6.8038E-04
6.0000E 01	2.2416E 00	---------+	2.3029E 00	2.9724E 00	4.5092E-04
6.3000E 01	2.1846E 00	---------+	2.2429E 00	2.8641E 00	2.9902E-04
6.6000E 01	2.1316E 00	--------+	2.1867E 00	2.7590E 00	1.9816E-04
6.9000E 01	2.0819E 00	--------+	2.1341E 00	2.6582E 00	1.3187E-04
7.2000E 01	2.0352E 00	--------+	2.0847E 00	2.5621E 00	8.7810E-05
7.5000E 01	1.9914E 00	-------+	2.0383E 00	2.4709E 00	5.8640E-05
7.8000E 01	1.9501E 00	-------+	1.9945E 00	2.3844E 00	3.9352E-05
8.1000E 01	1.9112E 00	-------+	1.9531E 00	2.3026E 00	2.6577E-05
8.4000E 01	1.8743E 00	------+	1.9139E 00	2.2252E 00	1.8147E-05
8.7000E 01	1.8394E 00	------+	1.8767E 00	2.1519E 00	1.2563E-05
9.0000E 01	1.8062E 00	------+	1.8413E 00	2.0824E 00	8.8549E-06
9.3000E 01	1.7746E 00	------+	1.8076E 00	2.0164E 00	6.4578E-06
9.6000E 01	1.7445E 00	-----+	1.7755E 00	1.9536E 00	4.7701E-06
9.9000E 01	1.7157E 00	-----+	1.7447E 00	1.8936E 00	3.7635E-06
1.0200E 02	1.6881E 00	-----+	1.7153E 00	1.8368E 00	3.0472E-06
1.0500E 02	1.6617E 00	-----+	1.6870E 00	1.7823E 00	2.7032E-06
1.0800E 02	1.6363E 00	-----+	1.6599E 00	1.7301E 00	2.7291E-06
1.1100E 02	1.6119E 00	---+	1.6338E 00	1.6801E 00	2.7291E-06
1.1400E 02	1.5885E 00	---+	1.6087E 00	1.6322E 00	2.7291E-06
1.1700E 02	1.5660E 00	---+	1.5846E 00	1.5861E 00	2.7291E-06
1.2000E 02	1.5446E 00	---+	1.5613E 00	1.5418E 00	2.7291E-06
1.2300E 02	1.5240E 00	---+	1.5387E 00	1.4992E 00	2.7291E-06
1.2600E 02	1.5042E 00	---+	1.5170E 00	1.4580E 00	2.7291E-06
1.2900E 02	1.4852E 00	--+	1.4959E 00	1.4184E 00	2.7291E-06
1.3200E 02	1.4668E 00	--+	1.4756E 00	1.3800E 00	2.7291E-06
1.3500E 02	1.4493E 00	--+	1.4559E 00	1.3430E 00	2.7291E-06
1.3800E 02	1.4324E 00	--+	1.4367E 00	1.3071E 00	2.7291E-06
1.4100E 02	1.4160E 00	--+	1.4182E 00	1.2724E 00	2.7291E-06
1.4400E 02	1.3931E 00	--+	1.4002E 00	1.2388E 00	2.7291E-06
1.4700E 02	1.3767E 00	--+	1.3827E 00	1.2062E 00	2.7291E-06
1.5000E 02	1.3611E 00	--+	1.3658E 00	1.1746E 00	9.2913E-04

FIGURE 21b (1) GLUCOSE LOAD TEST

MINIMUM 4.9975E-01 — IC1S — VERSUS TIME — MAXIMUM 3.3116E 00

TIME	IC1S	I	GC1K	IC1K	AC1K
0.0	5.0000E-01	+	1.0000E 00	5.0000E-01	6.0000E-02
3.0000E 00	6.4045E-01	--+	1.0745E 00	6.0256E-01	6.4266E-02
6.0000E 00	6.2272E-01	--+	1.0825E 00	5.8639E-01	6.6525E-02
9.0000E 00	6.0639E-01	--+	1.0831E 00	5.7066E-01	5.1205E-02
1.2000E 01	5.9324E-01	-+	1.0810E 00	5.5789E-01	4.7759E-02
1.5000E 01	5.8215E-01	-+	1.0777E 00	5.4716E-01	4.5629E-02
1.8000E 01	5.7236E-01	-+	1.0737E 00	5.3775E-01	4.4398E-02
2.1000E 01	5.6342E-01	-+	1.0696E 00	5.2922E-01	4.3766E-02
2.4000E 01	5.5512E-01	+	1.0654E 00	5.2133E-01	4.3535E-02
2.7000E 01	5.4732E-01	-+	1.0614E 00	5.1394E-01	4.3558E-02
3.0000E 01	1.6103E 00	----------+	8.0048E 00	1.4795E 00	3.1006E-02
3.3000E 01	2.6616E 00	----------+	3.3709E 00	2.3555E 00	1.9628E-02
3.6000E 01	3.0760E 00	----------+	3.0796E 00	2.8061E 00	1.2972E-02
3.9000E 01	3.2481E 00	----------+	2.9394E 00	3.0050E 00	8.5849E-03
4.2000E 01	3.3087E 00	----------+	2.8298E 00	3.0843E 00	5.6829E-03
4.5000E 01	3.2985E 00	----------+	2.7338E 00	3.0665E 00	3.7625E-03
4.8000E 01	3.2444E 00	----------+	2.6462E 00	3.0462E 00	2.4914E-03
5.1000E 01	3.1636E 00	----------+	2.5647E 00	2.9759E 00	1.5499E-03
5.4000E 01	3.0665E 00	----------+	2.4886E 00	2.8695E 00	1.0926E-03
5.7000E 01	2.9661E 00	----------+	2.4174E 00	2.7950E 00	7.2401E-04
6.0000E 01	2.8613E 00	----------+	2.3508E 00	2.6975E 00	4.7984E-04
6.3000E 01	2.7575E 00	----------+	2.2884E 00	2.6002E 00	3.1621E-04
6.6000E 01	2.6565E 00	----------+	2.2301E 00	2.5051E 00	2.1121E-04
6.9000E 01	2.5593E 00	----------+	2.1755E 00	2.4135E 00	1.4037E-04
7.2000E 01	2.4667E 00	----------+	2.1242E 00	2.3260E 00	9.3475E-05
7.5000E 01	2.3786E 00	----------+	2.0761E 00	2.2428E 00	6.2440E-05
7.8000E 01	2.2952E 00	----------+	2.0308E 00	2.1639E 00	4.1895E-05
8.1000E 01	2.2163E 00	----------+	1.9880E 00	2.0892E 00	2.8316E-05
8.4000E 01	2.1419E 00	----------+	1.9475E 00	2.0185E 00	1.9364E-05
8.7000E 01	2.0720E 00	----------+	1.9092E 00	1.9515E 00	1.3430E-05
9.0000E 01	2.0067E 00	----------+	1.8728E 00	1.8880E 00	9.4958E-06
9.3000E 01	1.9460E 00	----------+	1.8381E 00	1.8278E 00	6.9737E-06
9.6000E 01	1.8894E 00	----------+	1.8051E 00	1.7705E 00	5.1223E-06
9.9000E 01	1.8371E 00	----------+	1.7735E 00	1.7160E 00	4.0717E-06
1.0200E 02	1.7887E 00	----------+	1.7433E 00	1.6640E 00	3.3416E-06
1.0500E 02	1.7442E 00	----------+	1.7144E 00	1.6144E 00	3.0622E-06
1.0800E 02	1.7039E 00	----------+	1.6866E 00	1.5670E 00	2.9589E-06
1.1100E 02	1.6658E 00	----------+	1.6600E 00	1.5215E 00	2.9989E-06
1.1400E 02	1.6296E 00	----------+	1.6343E 00	1.4779E 00	2.9989E-06
1.1700E 02	1.5952E 00	----------+	1.6096E 00	1.4360E 00	2.9989E-06
1.2000E 02	1.5626E 00	----------+	1.5858E 00	1.3956E 00	2.9989E-06
1.2300E 02	1.5314E 00	----------+	1.5628E 00	1.3570E 00	2.9989E-06
1.2600E 02	1.5019E 00	----------+	1.5407E 00	1.3197E 00	2.9989E-06
1.2900E 02	1.4737E 00	----------+	1.5192E 00	1.2837E 00	2.9989E-06
1.3200E 02	1.4468E 00	----------+	1.4985E 00	1.2489E 00	2.9989E-06
1.3500E 02	1.4211E 00	----------+	1.4784E 00	1.2153E 00	2.9989E-06
1.3800E 02	1.3966E 00	----------+	1.4589E 00	1.1828E 00	2.9989E-06
1.4100E 02	1.3732E 00	----------+	1.4401E 00	1.1513E 00	2.9989E-06
1.4400E 02	1.3509E 00	----------+	1.4217E 00	1.1209E 00	2.9989E-06
1.4700E 02	1.3295E 00	----------+	1.4040E 00	1.0913E 00	2.9989E-06
1.5000E 02	1.3091E 00	----------+	1.3868E 00	1.0627E 00	5.7306E-04

FIGURE 21b (2) GLUCOSE LOAD TEST

SEW3L VERSUS TIME

MINIMUM 3.4113E 00 MAXIMUM 2.0378E 02

TIME	SEW3L	I	EW3L	GR22L1	ILOAD
0.0	3.4113E 00	+	1.0000E 01	0.0	0.0
3.0000E 00	7.2276E 00	+	1.0020E 01	0.0	0.0
6.0000E 00	7.2119E 00	+	1.0042E 01	0.0	0.0
9.0000E 00	7.0918E 00	+	1.0063E 01	0.0	0.0
1.2000E 01	6.9355E 00	+	1.0084E 01	0.0	0.0
1.5000E 01	6.7679E 00	+	1.0105E 01	0.0	0.0
1.8000E 01	6.6432E 00	+	1.0125E 01	0.0	0.0
2.1000E 01	6.5035E 00	+	1.0145E 01	0.0	0.0
2.4000E 01	6.3697E 00	+	1.0164E 01	0.0	0.0
2.7000E 01	6.2426E 00	+	1.0183E 01	0.0	0.0
3.0000E 01	2.0378E 02	----------+	1.0384E 01	0.0	0.0
3.3000E 01	7.5612E 01	----------+	1.0690E 01	0.0	0.0
3.6000E 01	6.9171E 01	----------+	1.0905E 01	0.0	0.0
3.9000E 01	6.4165E 01	----------+	1.1103E 01	0.0	0.0
4.2000E 01	6.0885E 01	----------+	1.1291E 01	0.0	0.0
4.5000E 01	5.7697E 01	----------+	1.1469E 01	0.0	0.0
4.8000E 01	5.4996E 01	----------+	1.1638E 01	0.0	0.0
5.1000E 01	5.2276E 01	----------+	1.1799E 01	0.0	0.0
5.4000E 01	4.9692E 01	----------+	1.1952E 01	0.0	0.0
5.7000E 01	4.7243E 01	----------+	1.2097E 01	0.0	0.0
6.0000E 01	4.4939E 01	----------+	1.2236E 01	0.0	0.0
6.3000E 01	4.2749E 01	----------+	1.2367E 01	0.0	0.0
6.6000E 01	4.0696E 01	----------+	1.2492E 01	0.0	0.0
6.9000E 01	3.8784E 01	----------+	1.2612E 01	0.0	0.0
7.2000E 01	3.6946E 01	----------+	1.2725E 01	0.0	0.0
7.5000E 01	3.5233E 01	----------+	1.2833E 01	0.0	0.0
7.8000E 01	3.3619E 01	----------+	1.2937E 01	0.0	0.0
8.1000E 01	3.2096E 01	----------+	1.3035E 01	0.0	0.0
8.4000E 01	3.0657E 01	----------+	1.3129E 01	0.0	0.0
8.7000E 01	2.9295E 01	----------+	1.3219E 01	0.0	0.0
9.0000E 01	2.8004E 01	----------+	1.3305E 01	0.0	0.0
9.3000E 01	2.6780E 01	----------+	1.3387E 01	0.0	0.0
9.6000E 01	2.5617E 01	----------+	1.3466E 01	0.0	0.0
9.9000E 01	2.4511E 01	----------+	1.3541E 01	0.0	0.0
1.0200E 02	2.3459E 01	----------+	1.3613E 01	0.0	0.0
1.0500E 02	2.2456E 01	----------+	1.3682E 01	0.0	0.0
1.0800E 02	2.1498E 01	----------+	1.3746E 01	0.0	0.0
1.1100E 02	2.0585E 01	----------+	1.3811E 01	0.0	0.0
1.1400E 02	1.9712E 01	----------+	1.3872E 01	0.0	0.0
1.1700E 02	1.8878E 01	----------+	1.3930E 01	0.0	0.0
1.2000E 02	1.8079E 01	----------+	1.3985E 01	0.0	0.0
1.2300E 02	1.7315E 01	----------+	1.4038E 01	0.0	0.0
1.2600E 02	1.6582E 01	----------+	1.4089E 01	0.0	0.0
1.2900E 02	1.5881E 01	----------+	1.4137E 01	0.0	0.0
1.3200E 02	1.5208E 01	----------+	1.4184E 01	0.0	0.0
1.3500E 02	1.4563E 01	----------+	1.4229E 01	0.0	0.0
1.3800E 02	1.3943E 01	----------+	1.4271E 01	0.0	0.0
1.4100E 02	1.3349E 01	----------+	1.4312E 01	0.0	0.0
1.4400E 02	1.2777E 01	----------+	1.4351E 01	0.0	0.0
1.4700E 02	1.2229E 01	----------+	1.4389E 01	0.0	0.0
1.5000E 02	1.1703E 01	----------+	1.4424E 01	0.0	0.0

FIGURE 21c (1) GLUCOSE LOAD TEST

GC11L VERSUS TIME

MINIMUM 1.0000E 00 — MAXIMUM 8.5826E 00

TIME	GC11L	I	GR22L2	GR22L3	GR22L4
0.0	1.0000E 00	+	3.9815E 01	7.1478E 00	2.7800E 00
3.0000E 00	1.0675E 00	+	2.5767E 01	7.8244E 00	2.7800E 00
6.0000E 00	1.0729E 00	+	1.7114E 01	7.5347E 00	2.7800E 00
9.0000E 00	1.0722E 00	+	1.2568E 01	7.3560E 00	2.7800E 00
1.2000E 01	1.0695E 00	+	1.0094E 01	7.2522E 00	2.7800E 00
1.5000E 01	1.0656E 00	+	8.7108E 00	7.2010E 00	2.7800E 00
1.8000E 01	1.0617E 00	+	7.9417E 00	7.1654E 00	2.7800E 00
2.1000E 01	1.0575E 00	+	7.5380E 00	7.1934E 00	2.7800E 00
2.4000E 01	1.0533E 00	+	7.3599E 00	7.2164E 00	2.7800E 00
2.7000E 01	1.0492E 00	+	7.3236E 00	7.2486E 00	2.7800E 00
3.0000E 01	6.5461E 00	----------	3.9655E 00	4.6310E 00	2.7800E 00
3.3000E 01	3.3214E 00	----------	6.4223E-01	4.1524E 00	2.7800E 00
3.6000E 01	2.0409E 00	----------	1.3292E-01	3.8762E 00	2.7800E 00
3.9000E 01	2.9874E 00	----------	3.5223E-02	3.6947E 00	2.7800E 00
4.2000E 01	2.6320E 00	----------	1.0119E-02	3.5743E 00	2.7800E 00
4.5000E 01	2.7565E 00	----------	2.9984E-03	3.4944E 00	2.7800E 00
4.8000E 01	2.6275E 00	----------	8.7452E-04	3.4415E 00	2.7800E 00
5.1000E 01	2.5421E 00	----------	2.4986E-04	3.4067E 00	2.7800E 00
5.4000E 01	2.4866E 00	----------	1.2493E-04	3.3836E 00	2.7800E 00
5.7000E 01	2.3963E 00	----------	0.0	3.3650E 00	2.7800E 00
6.0000E 01	2.3303E 00	--------	0.0	3.3597E 00	2.7800E 00
6.3000E 01	2.2665E 00	--------	0.0	3.3539E 00	2.7800E 00
6.6000E 01	2.2107E 00	--------	0.0	3.3507E 00	2.7800E 00
6.9000E 01	2.1566E 00	--------	0.0	3.3493E 00	2.7800E 00
7.2000E 01	2.1056E 00	--------	0.0	3.3490E 00	2.7800E 00
7.5000E 01	2.0581E 00	-------	0.0	3.3497E 00	2.7800E 00
7.8000E 01	2.0131E 00	-------	0.0	3.3511E 00	2.7800E 00
8.1000E 01	1.9707E 00	-------	0.0	3.3531E 00	2.7800E 00
8.4000E 01	1.9305E 00	-------	0.0	3.3555E 00	2.7800E 00
8.7000E 01	1.8925E 00	------	0.0	3.3583E 00	2.7800E 00
9.0000E 01	1.8563E 00	------	0.0	3.3614E 00	2.7800E 00
9.3000E 01	1.8219E 00	------	0.0	3.3650E 00	2.7800E 00
9.6000E 01	1.7891E 00	------	0.0	3.3688E 00	2.7800E 00
9.9000E 01	1.7577E 00	------	0.0	3.3730E 00	2.7800E 00
1.0200E 02	1.7277E 00	-----	0.0	3.3775E 00	2.7800E 00
1.0500E 02	1.6989E 00	-----	0.0	3.3823E 00	2.7800E 00
1.0800E 02	1.6713E 00	-----	0.0	3.3874E 00	2.7800E 00
1.1100E 02	1.6448E 00	-----	0.0	3.3929E 00	2.7800E 00
1.1400E 02	1.6193E 00	-----	0.0	3.3986E 00	2.7800E 00
1.1700E 02	1.5947E 00	-----	0.0	3.4047E 00	2.7800E 00
1.2000E 02	1.5710E 00	----	0.0	3.4112E 00	2.7800E 00
1.2300E 02	1.5482E 00	----	0.0	3.4179E 00	2.7800E 00
1.2600E 02	1.5261E 00	----	0.0	3.4250E 00	2.7800E 00
1.2900E 02	1.5046E 00	----	0.0	3.4324E 00	2.7800E 00
1.3200E 02	1.4841E 00	----	0.0	3.4401E 00	2.7800E 00
1.3500E 02	1.4641E 00	----	0.0	3.4482E 00	2.7800E 00
1.3800E 02	1.4447E 00	---	0.0	3.4566E 00	2.7800E 00
1.4100E 02	1.4259E 00	---	0.0	3.4653E 00	2.7800E 00
1.4400E 02	1.4077E 00	----	0.0	3.4743E 00	2.7800E 00
1.4700E 02	1.3900E 00	---	0.0	3.4837E 00	2.7800E 00
1.5000E 02	1.3729E 00	---	0.0	3.5872E 00	2.7800E 00

FIGURE 21c (2) GLUCOSE LOAD TEST

IC22P VERSUS TIME

MINIMUM 4.1165E 00 — MAXIMUM 3.5796E 01

TIME	IC22P	LIR	LAR	GC1P
0.0	4.1171E 00	1.4200E 02	1.6800E 01	1.0000E 00
3.0000E 00	5.1683E 00	1.7850E 02	1.3803E 01	1.0694E 00
6.0000E 00	5.2141E 00	1.8095E 02	1.3601E 01	1.0741E 00
9.0000E 00	5.1588E 00	1.8027E 02	1.3657E 01	1.0726E 00
1.2000E 01	5.1262E 00	1.7863E 02	1.3791E 01	1.0696E 00
1.5000E 01	5.0681E 00	1.7656E 02	1.3960E 01	1.0657E 00
1.8000E 01	4.9970E 00	1.7436E 02	1.4142E 01	1.0615E 00
2.1000E 01	4.9306E 00	1.7211E 02	1.4327E 01	1.0572E 00
2.4000E 01	4.8663E 00	1.6989E 02	1.4509E 01	1.0530E 00
2.7000E 01	4.8043E 00	1.6776E 02	1.4684E 01	1.0490E 00
3.0000E 01	3.4773E 01	1.3000E 03	0.0	8.9561E 00
3.3000E 01	3.5640E 01	1.3000E 03	0.0	9.3235E 00
3.6000E 01	3.5772E 01	1.2696E 03	0.0	9.3806E 00
3.9000E 01	3.2167E 01	1.1597E 03	0.0	2.8967E 00
4.2000E 01	3.0847E 01	1.0852E 03	0.0	2.7932E 00
4.5000E 01	2.9611E 01	1.0369E 03	0.0	2.7013E 00
4.8000E 01	2.8422E 01	9.9217E 02	0.0	2.6163E 00
5.1000E 01	2.7278E 01	9.5026E 02	0.0	2.5366E 00
5.4000E 01	2.6194E 01	9.1091E 02	0.0	2.4616E 00
5.7000E 01	2.5146E 01	8.7401E 02	0.0	2.3917E 00
6.0000E 01	2.4164E 01	8.3946E 02	0.0	2.3260E 00
6.3000E 01	2.3240E 01	8.0713E 02	0.0	2.2645E 00
6.6000E 01	2.2371E 01	7.7687E 02	0.0	2.2070E 00
6.9000E 01	2.1554E 01	7.4852E 02	0.0	2.1531E 00
7.2000E 01	2.0787E 01	7.2192E 02	0.0	2.1025E 00
7.5000E 01	2.0064E 01	6.9692E 02	0.0	2.0550E 00
7.8000E 01	1.9383E 01	6.7337E 02	0.0	2.0102E 00
8.1000E 01	1.8740E 01	6.5114E 02	0.0	1.9679E 00
8.4000E 01	1.8131E 01	6.3010E 02	0.0	1.9279E 00
8.7000E 01	1.7554E 01	6.1015E 02	0.0	1.8900E 00
9.0000E 01	1.7006E 01	5.9120E 02	0.0	1.8540E 00
9.3000E 01	1.6485E 01	5.7316E 02	0.0	1.8197E 00
9.6000E 01	1.5987E 01	5.5594E 02	0.0	1.7870E 00
9.9000E 01	1.5512E 01	5.3950E 02	0.0	1.7557E 00
1.0200E 02	1.5058E 01	5.2376E 02	0.0	1.7258E 00
1.0500E 02	1.4622E 01	5.0867E 02	0.0	1.6971E 00
1.0800E 02	1.4205E 01	4.9420E 02	0.0	1.6696E 00
1.1100E 02	1.3804E 01	4.8028E 02	0.0	1.6431E 00
1.1400E 02	1.3418E 01	4.6690E 02	0.0	1.6177E 00
1.1700E 02	1.3046E 01	4.5401E 02	0.0	1.5932E 00
1.2000E 02	1.2688E 01	4.4156E 02	0.0	1.5695E 00
1.2300E 02	1.2343E 01	4.2959E 02	0.0	1.5467E 00
1.2600E 02	1.2009E 01	4.1800E 02	0.0	1.5247E 00
1.2900E 02	1.1687E 01	4.0680E 02	0.0	1.5034E 00
1.3200E 02	1.1375E 01	3.9596E 02	0.0	1.4828E 00
1.3500E 02	1.1073E 01	3.8546E 02	0.0	1.4629E 00
1.3800E 02	1.0780E 01	3.7529E 02	0.0	1.4435E 00
1.4100E 02	1.0496E 01	3.6543E 02	0.0	1.4248E 00
1.4400E 02	1.0221E 01	3.5585E 02	0.0	1.4066E 00
1.4700E 02	9.9539E 00	3.4656E 02	0.0	1.3889E 00
1.5000E 02	9.6955E 00	3.3757E 02	7.3765E-01	1.3718E 00

FIGURE 21d (1) GLUCOSE LOAD TEST

AC22P - VERSUS TIME

MINIMUM 2.7344E-06 — MAXIMUM 4.8794E-01

TIME	AC22P	GCII	ICII	ACII
0.0	4.8794E-01	1.0000E 00	5.0000E-01	6.0000E-02
3.0000E 00	4.1708E-01	1.0587E 00	5.8896E-01	6.3615E-02
6.0000E 00	4.0410E-01	1.0691E 00	5.7718E-01	5.6365E-02
9.0000E 00	4.0026E-01	1.0710E 00	5.6272E-01	5.1025E-02
1.2000E 01	4.0032E-01	1.0696E 00	5.5022E-01	4.7447E-02
1.5000E 01	4.0256E-01	1.0665E 00	5.3952E-01	4.5187E-02
1.8000E 01	4.0803E-01	1.0627E 00	5.3012E-01	4.3853E-02
2.1000E 01	4.1017E-01	1.0586E 00	5.2161E-01	4.3147E-02
2.4000E 01	4.1461E-01	1.0544E 00	5.1376E-01	4.2860E-02
2.7000E 01	4.1913E-01	1.0504E 00	5.0642E-01	4.2844E-02
3.0000E 01	3.0436E-02	7.0487E 00	1.3175E 00	3.2286E-02
3.3000E 01	1.9172E-02	3.4365E 00	2.2109E 00	2.0678E-02
3.6000E 01	1.2640E-02	3.1180E 00	2.6953E 00	1.3712E-02
3.9000E 01	8.5985E-03	2.9585E 00	2.9215E 00	9.0574E-03
4.2000E 01	5.5316E-03	2.8394E 00	3.0181E 00	6.0193E-03
4.5000E 01	3.8622E-03	2.7390E 00	3.0539E 00	3.9862E-03
4.8000E 01	2.4249E-03	2.6491E 00	2.9995E 00	2.5297E-03
5.1000E 01	1.6356E-03	2.5663E 00	2.9347E 00	1.7482E-03
5.4000E 01	1.0838E-03	2.4892E 00	2.8523E 00	1.1579E-03
5.7000E 01	7.6462E-04	2.4171E 00	2.7607E 00	7.6704E-04
6.0000E 01	4.6697E-04	2.3498E 00	2.6654E 00	5.0830E-04
6.3000E 01	3.0964E-04	2.2867E 00	2.5698E 00	3.3701E-04
6.6000E 01	2.6546E-04	2.2278E 00	2.4761E 00	2.2350E-04
6.9000E 01	1.8653E-04	2.1726E 00	2.3857E 00	1.4853E-04
7.2000E 01	9.8990E-05	2.1206E 00	2.2991E 00	9.8817E-05
7.5000E 01	6.0695E-05	2.0721E 00	2.2167E 00	6.5930E-05
7.8000E 01	4.0703E-05	2.0264E 00	2.1385E 00	4.4139E-05
8.1000E 01	2.7476E-05	1.9832E 00	2.0645E 00	2.9795E-05
8.4000E 01	1.8736E-05	1.9422E 00	1.9944E 00	2.0256E-05
8.7000E 01	1.2782E-05	1.9036E 00	1.9281E 00	1.3955E-05
9.0000E 01	9.0972E-06	1.8669E 00	1.8652E 00	9.7677E-06
9.3000E 01	6.6365E-06	1.8320E 00	1.8055E 00	7.0706E-06
9.6000E 01	4.9246E-06	1.7987E 00	1.7488E 00	5.2030E-06
9.9000E 01	3.8370E-06	1.7669E 00	1.6948E 00	4.0606E-06
1.0200E 02	3.0720E-06	1.7365E 00	1.6434E 00	3.2112E-06
1.0500E 02	2.8067E-06	1.7073E 00	1.5945E 00	2.8535E-06
1.0800E 02	2.7344E-06	1.6794E 00	1.5479E 00	2.7493E-06
1.1100E 02	2.7344E-06	1.6529E 00	1.5023E 00	2.7493E-06
1.1400E 02	2.7344E-06	1.6267E 00	1.4592E 00	2.7493E-06
1.1700E 02	2.7344E-06	1.6019E 00	1.4178E 00	2.7493E-06
1.2000E 02	2.7344E-06	1.5779E 00	1.3780E 00	2.7493E-06
1.2300E 02	2.7344E-06	1.5548E 00	1.3397E 00	2.7493E-06
1.2600E 02	2.7344E-06	1.5325E 00	1.3028E 00	2.7493E-06
1.2900E 02	2.7344E-06	1.5110E 00	1.2672E 00	2.7493E-06
1.3200E 02	2.7344E-06	1.4901E 00	1.2328E 00	2.7493E-06
1.3500E 02	2.7344E-06	1.4699E 00	1.1996E 00	2.7493E-06
1.3800E 02	2.7344E-06	1.4504E 00	1.1675E 00	2.7493E-06
1.4100E 02	2.7344E-06	1.4314E 00	1.1364E 00	2.7493E-06
1.4400E 02	2.7344E-06	1.4130E 00	1.1063E 00	2.7493E-06
1.4700E 02	2.7344E-06	1.3951E 00	1.0771E 00	2.7493E-06
1.5000E 02	1.9458E-02	1.3779E 00	1.0489E 00	4.9067E-04

FIGURE 21d (2) GLUCOSE LOAD TEST

MINIMUM SEW3M VERSUS TIME MAXIMUM
2.0534E-01 4.4917E 01

TIME	SEW3M	I	EW3M	GK23M	IE2M
0.0	1.2907E 00	+	0.0	1.2907E 00	5.0000E-01
3.0000E 00	4.8125E-01	+	2.2200E 00	4.7535E-01	3.3531E-01
6.0000E 00	3.4062E-01	+	3.4156E 00	3.3056E-01	2.8996E-01
9.0000E 00	2.9021E-01	+	4.3531E 00	2.7793E-01	2.7053E-01
1.2000E 01	2.6527E-01	+	5.1834E 00	2.5207E-01	2.6016E-01
1.5000E 01	2.4944E-01	+	5.9545E 00	2.3601E-01	2.5340E-01
1.8000E 01	2.3736E-01	+	6.6843E 00	2.2419E-01	2.4825E-01
2.1000E 01	2.2710E-01	+	7.3809E 00	2.1452E-01	2.4391E-01
2.4000E 01	2.1790E-01	+	8.0484E 00	2.0610E-01	2.4003E-01
2.7000E 01	2.0945E-01	+	8.6894E 00	1.9853E-01	2.3647E-01
3.0000E 01	2.0479E-01	+	9.5560E 00	5.2801E-01	3.4970E-01
3.3000E 01	1.0727E 01	----------+	2.4192E 01	3.9914E 00	7.8539E-01
3.6000E 01	2.5926E 01	----------+	7.8770E 01	9.2410E 00	1.0986E 00
3.9000E 01	3.7461E 01	----------+	1.7499E 02	1.3380E 01	1.2741E 00
4.2000E 01	4.3361E 01	----------+	2.9740E 02	1.5783E 01	1.3612E 00
4.5000E 01	4.4915E 01	----------+	4.3069E 02	1.6768E 01	1.3945E 00
4.8000E 01	4.3671E 01	----------+	5.6410E 02	1.6775E 01	1.3946E 00
5.1000E 01	4.0914E 01	----------+	6.9130E 02	1.6175E 01	1.3746E 00
5.4000E 01	3.7481E 01	----------+	8.0906E 02	1.5240E 01	1.3422E 00
5.7000E 01	3.3676E 01	----------+	9.1616E 02	1.4149E 01	1.3030E 00
6.0000E 01	3.0378E 01	----------+	1.0126E 03	1.3018E 01	1.2602E 00
6.3000E 01	2.7122E 01	----------+	1.0989E 03	1.1912E 01	1.2163E 00
6.6000E 01	2.4134E 01	----------+	1.1756E 03	1.0869E 01	1.1725E 00
6.9000E 01	2.1556E 01	----------+	1.2444E 03	9.9064E 00	1.1296E 00
7.2000E 01	1.9228E 01	----------+	1.3056E 03	9.0293E 00	1.0887E 00
7.5000E 01	1.7179E 01	----------+	1.3601E 03	8.2364E 00	1.0494E 00
7.8000E 01	1.5378E 01	----------+	1.4090E 03	7.5227E 00	1.0120E 00
8.1000E 01	1.3795E 01	----------+	1.4527E 03	6.8815E 00	9.7656E-01
8.4000E 01	1.2403E 01	----------+	1.4920E 03	6.3056E 00	9.4303E-01
8.7000E 01	1.1176E 01	----------+	1.5273E 03	5.7870E 00	9.1120E-01
9.0000E 01	1.0092E 01	----------+	1.5592E 03	5.3217E 00	8.8116E-01
9.3000E 01	9.1515E 00	---------+	1.5880E 03	4.9012E 00	8.5262E-01
9.6000E 01	8.2785E 00	---------+	1.6141E 03	4.5210E 00	8.2553E-01
9.9000E 01	7.5196E 00	---------+	1.6376E 03	4.1765E 00	7.9976E-01
1.0200E 02	6.8421E 00	--------+	1.6594E 03	3.8639E 00	7.7523E-01
1.0500E 02	6.2255E 00	-------+	1.6796E 03	3.5765E 00	7.5192E-01
1.0800E 02	5.6610E 00	-------+	1.6969E 03	3.3184E 00	7.2947E-01
1.1100E 02	5.2013E 00	-----+	1.7132E 03	3.0805E 00	7.0858E-01
1.1400E 02	4.7596E 00	-----+	1.7281E 03	2.8625E 00	6.8759E-01
1.1700E 02	4.3610E 00	-----+	1.7416E 03	2.6623E 00	6.6794E-01
1.2000E 02	3.9966E 00	----+	1.7543E 03	2.4781E 00	6.4906E-01
1.2300E 02	3.6725E 00	---+	1.7658E 03	2.3085E 00	6.3091E-01
1.2600E 02	3.3750E 00	---+	1.7764E 03	2.1519E 00	6.1342E-01
1.2900E 02	3.1042E 00	---+	1.7861E 03	2.0071E 00	5.9658E-01
1.3200E 02	2.8575E 00	--+	1.7950E 03	1.8732E 00	5.8032E-01
1.3500E 02	2.6323E 00	--+	1.8033E 03	1.7491E 00	5.6462E-01
1.3800E 02	2.4265E 00	--+	1.8109E 03	1.6339E 00	5.4945E-01
1.4100E 02	2.2381E 00	--+	1.8178E 03	1.5270E 00	5.3477E-01
1.4400E 02	2.0656E 00	--+	1.8243E 03	1.4275E 00	5.2056E-01
1.4700E 02	1.9073E 00	-+	1.8302E 03	1.3350E 00	5.0679E-01
1.5000E 02	1.7620E 00	-+	1.8357E 03	1.2488E 00	4.9344E-01

FIGURE 21e (1) GLUCOSE LOAD TEST

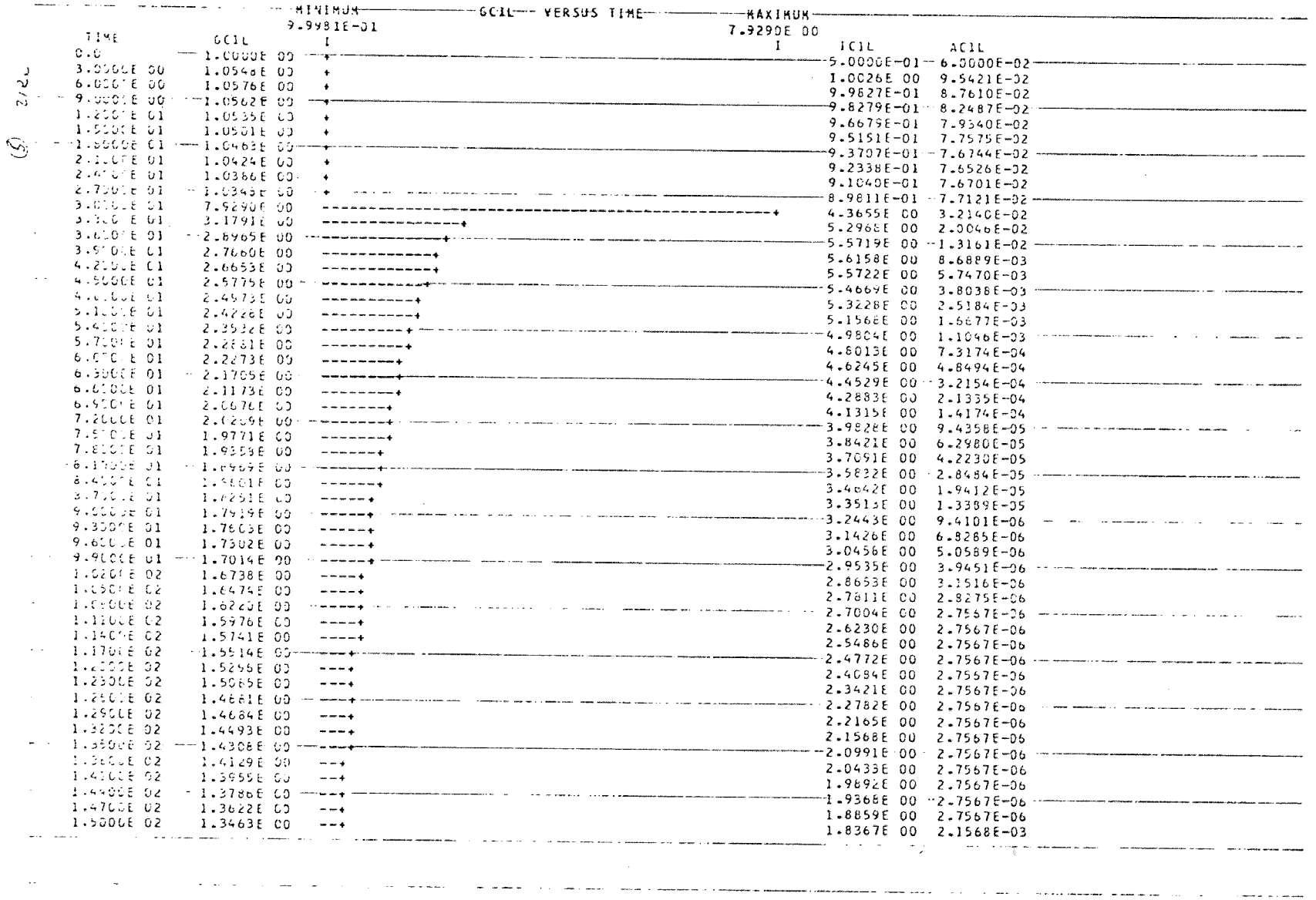
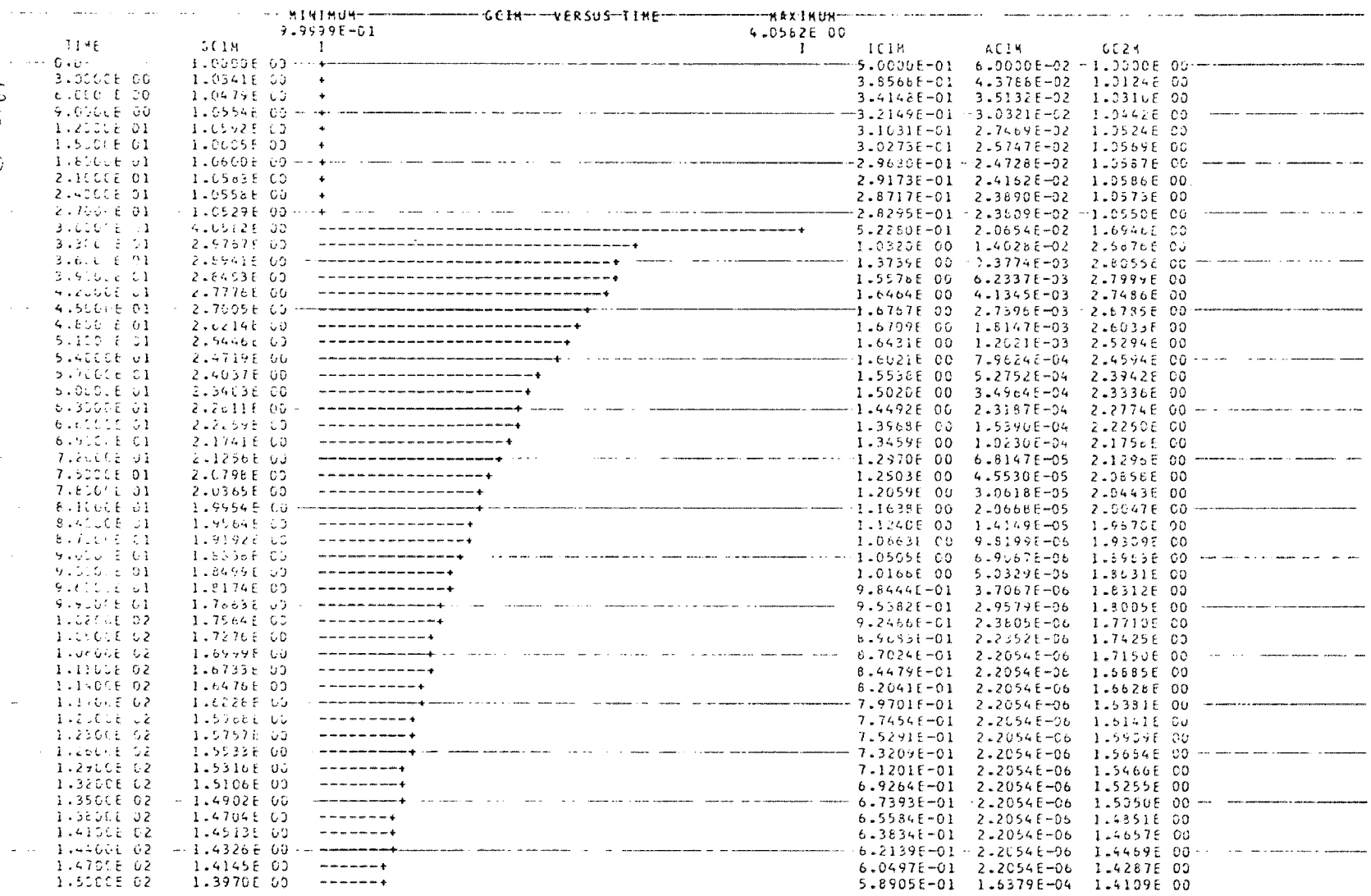


FIGURE 21e (2) GLUCOSE LOAD TEST



TIME	GCIM	ICIM	ACIM	GC24
0.0	1.0000E 00	5.0000E-01	6.0000E-02	1.0000E 00
3.0000E 00	1.0341E 00	3.8566E-01	4.3786E-02	1.0124E 00
6.0000E 00	1.0479E 00	3.4148E-01	3.5132E-02	1.0310E 00
9.0000E 00	1.0554E 00	3.2149E-01	3.0321E-02	1.0442E 00
1.2000E 01	1.0592E 00	3.1031E-01	2.7469E-02	1.0524E 00
1.5000E 01	1.0605E 00	3.0273E-01	2.5747E-02	1.0569E 00
1.8000E 01	1.0600E 00	2.9630E-01	2.4728E-02	1.0567E 00
2.1000E 01	1.0583E 00	2.9173E-01	2.4162E-02	1.0586E 00
2.4000E 01	1.0558E 00	2.8717E-01	2.3890E-02	1.0573E 00
2.7000E 01	1.0529E 00	2.8295E-01	2.3809E-02	1.0550E 00
3.0000E 01	4.0562E 00	5.2250E-01	2.0654E-02	1.6946E 00
3.3000E 01	2.9767E 00	1.0320E 00	1.4028E-02	2.5676E 00
3.6000E 01	2.5941E 00	1.3759E 00	9.3774E-03	2.8055E 00
3.9000E 01	2.6453E 00	1.5576E 00	6.2337E-03	2.7994E 00
4.2000E 01	2.7776E 00	1.6464E 00	4.1345E-03	2.7486E 00
4.5000E 01	2.7005E 00	1.6767E 00	2.7596E-03	2.6785E 00
4.8000E 01	2.6214E 00	1.6709E 00	1.8147E-03	2.6033E 00
5.1000E 01	2.5446E 00	1.6431E 00	1.2021E-03	2.5294E 00
5.4000E 01	2.4719E 00	1.6021E 00	7.9624E-04	2.4594E 00
5.7000E 01	2.4037E 00	1.5538E 00	5.2752E-04	2.3942E 00
6.0000E 01	2.3403E 00	1.5020E 00	3.4964E-04	2.3336E 00
6.3000E 01	2.2811E 00	1.4492E 00	2.3187E-04	2.2774E 00
6.6000E 01	2.2259E 00	1.3968E 00	1.5390E-04	2.2250E 00
6.9000E 01	2.1741E 00	1.3459E 00	1.0230E-04	2.1756E 00
7.2000E 01	2.1256E 00	1.2970E 00	6.8147E-05	2.1296E 00
7.5000E 01	2.0798E 00	1.2503E 00	4.5530E-05	2.0858E 00
7.8000E 01	2.0365E 00	1.2059E 00	3.0618E-05	2.0443E 00
8.1000E 01	1.9954E 00	1.1639E 00	2.0668E-05	2.0047E 00
8.4000E 01	1.9564E 00	1.1240E 00	1.4149E-05	1.9670E 00
8.7000E 01	1.9192E 00	1.0863E 00	9.5199E-06	1.9309E 00
9.0000E 01	1.8838E 00	1.0505E 00	6.9067E-06	1.8965E 00
9.3000E 01	1.8499E 00	1.0166E 00	5.0329E-06	1.8638E 00
9.6000E 01	1.8174E 00	9.8444E-01	3.7067E-06	1.8312E 00
9.9000E 01	1.7863E 00	9.5582E-01	2.9579E-06	1.8005E 00
1.0200E 02	1.7564E 00	9.2466E-01	2.3805E-06	1.7710E 00
1.0500E 02	1.7276E 00	8.9653E-01	2.2552E-06	1.7425E 00
1.0800E 02	1.6999E 00	8.7024E-01	2.2054E-06	1.7150E 00
1.1100E 02	1.6733E 00	8.4479E-01	2.2054E-06	1.6885E 00
1.1400E 02	1.6476E 00	8.2041E-01	2.2054E-06	1.6628E 00
1.1700E 02	1.6228E 00	7.9701E-01	2.2054E-06	1.6381E 00
1.2000E 02	1.5988E 00	7.7454E-01	2.2054E-06	1.6141E 00
1.2300E 02	1.5757E 00	7.5291E-01	2.2054E-06	1.5909E 00
1.2600E 02	1.5533E 00	7.3209E-01	2.2054E-06	1.5684E 00
1.2900E 02	1.5316E 00	7.1201E-01	2.2054E-06	1.5466E 00
1.3200E 02	1.5106E 00	6.9264E-01	2.2054E-06	1.5255E 00
1.3500E 02	1.4902E 00	6.7393E-01	2.2054E-06	1.5050E 00
1.3800E 02	1.4704E 00	6.5584E-01	2.2054E-06	1.4851E 00
1.4100E 02	1.4513E 00	6.3834E-01	2.2054E-06	1.4657E 00
1.4400E 02	1.4326E 00	6.2139E-01	2.2054E-06	1.4469E 00
1.4700E 02	1.4145E 00	6.0497E-01	2.2054E-06	1.4287E 00
1.5000E 02	1.3970E 00	5.8905E-01	1.6379E-04	1.4109E 00

FIGURE 21f (1) GLUCOSE LOAD TEST

TIME	GRDELT	GRIN	GROUT	GCIR
0.0	2.8291E 01	5.5993E 01	2.7702E 01	1.3000E 00
3.0000E 00	1.1913E 01	4.2622E 01	3.0709E 01	1.0735E 00
6.0000E 00	3.1260E 00	3.3679E 01	3.0553E 01	1.0752E 00
9.0000E 00	-1.4185E 00	2.9953E 01	3.0372E 01	1.0729E 00
1.2000E 01	-3.2245E 00	2.6376E 01	3.0201E 01	1.0693E 00
1.5000E 01	-5.0955E 00	2.4942E 01	3.0037E 01	1.0653E 00
1.8000E 01	-5.7234E 00	2.4157E 01	2.9881E 01	1.0516E 00
2.1000E 01	-5.9591E 00	2.3761E 01	2.9731E 01	1.0567E 00
2.4000E 01	-5.9613E 00	2.3606E 01	2.9588E 01	1.0524E 00
2.7000E 01	-5.8697E 00	2.3602E 01	2.9452E 01	1.0484E 00
3.0000E 01	-2.1005E 02	1.7626E 01	2.2768E 02	6.2296E 00
3.3000E 01	-9.5714E 01	1.3825E 01	1.0954E 02	3.2296E 00
3.6000E 01	-1.0406E 02	1.3039E 01	1.1710E 02	2.9875E 00
3.9000E 01	-1.1159E 02	1.2760E 01	1.2465E 02	2.8731E 00
4.2000E 01	-1.1465E 02	1.2614E 01	1.2727E 02	2.7757E 00
4.5000E 01	-1.1524E 02	1.2527E 01	1.2577E 02	2.6878E 00
4.8000E 01	-1.0919E 02	1.2472E 01	1.2167E 02	2.6042E 00
5.1000E 01	-1.0375E 02	1.2437E 01	1.1619E 02	2.5254E 00
5.4000E 01	-9.7759E 01	1.2414E 01	1.1017E 02	2.4515E 00
5.7000E 01	-9.1720E 01	1.2399E 01	1.0412E 02	2.3819E 00
6.0000E 01	-8.5918E 01	1.2390E 01	9.8508E 01	2.3166E 00
6.3000E 01	-8.0496E 01	1.2384E 01	9.2877E 01	2.2559E 00
6.6000E 01	-7.5499E 01	1.2381E 01	8.7879E 01	2.1989E 00
6.9000E 01	-7.0934E 01	1.2379E 01	8.3319E 01	2.1456E 00
7.2000E 01	-6.6795E 01	1.2379E 01	7.9174E 01	2.0955E 00
7.5000E 01	-6.3033E 01	1.2380E 01	7.5413E 01	2.0483E 00
7.8000E 01	-5.9517E 01	1.2381E 01	7.1998E 01	2.0040E 00
8.1000E 01	-5.6502E 01	1.2383E 01	6.8692E 01	1.9620E 00
8.4000E 01	-5.3674E 01	1.2385E 01	6.6059E 01	1.9224E 00
8.7000E 01	-5.1042E 01	1.2386E 01	6.3470E 01	1.8847E 00
9.0000E 01	-4.8704E 01	1.2391E 01	6.1096E 01	1.8490E 00
9.3000E 01	-4.6516E 01	1.2395E 01	5.8911E 01	1.8149E 00
9.6000E 01	-4.4497E 01	1.2399E 01	5.6896E 01	1.7824E 00
9.9000E 01	-4.2628E 01	1.2403E 01	5.5031E 01	1.7513E 00
1.0200E 02	-4.0895E 01	1.2407E 01	5.3301E 01	1.7216E 00
1.0500E 02	-3.9278E 01	1.2412E 01	5.1691E 01	1.6931E 00
1.0800E 02	-3.7772E 01	1.2417E 01	5.0189E 01	1.6657E 00
1.1100E 02	-3.6363E 01	1.2423E 01	4.8786E 01	1.6394E 00
1.1400E 02	-3.5043E 01	1.2429E 01	4.7472E 01	1.6141E 00
1.1700E 02	-3.3804E 01	1.2435E 01	4.6239E 01	1.5898E 00
1.2000E 02	-3.2638E 01	1.2441E 01	4.5079E 01	1.5663E 00
1.2300E 02	-3.1539E 01	1.2448E 01	4.3987E 01	1.5436E 00
1.2600E 02	-3.0502E 01	1.2455E 01	4.2957E 01	1.5216E 00
1.2900E 02	-2.9523E 01	1.2462E 01	4.1985E 01	1.5004E 00
1.3200E 02	-2.8595E 01	1.2470E 01	4.1066E 01	1.4799E 00
1.3500E 02	-2.7717E 01	1.2478E 01	4.0195E 01	1.4601E 00
1.3800E 02	-2.6883E 01	1.2487E 01	3.9370E 01	1.4408E 00
1.4100E 02	-2.6091E 01	1.2495E 01	3.8587E 01	1.4221E 00
1.4400E 02	-2.5339E 01	1.2504E 01	3.7843E 01	1.4040E 00
1.4700E 02	-2.4622E 01	1.2514E 01	3.7136E 01	1.3864E 00
1.5000E 02	-2.3848E 01	1.2617E 01	3.6465E 01	1.3694E 00

FIGURE 21f (2) GLUCOSE LOAD TEST

MINIMUM 2.1904E-01 SEW3L VERSUS TIME MAXIMUM 1.1777E 01

TIME	SEW3L	I	EW3L	GR22L1	ILOAD
0.0	8.9589E-01	--+	1.6000E 01	9.9878E 00	0.0
5.0000E 00	2.8981E 00	----------+	1.6007E 01	0.0	0.0
1.0000E 01	2.6636E 00	----------+	1.6022E 01	0.0	0.0
1.5000E 01	2.7762E 00	----------+	1.6036E 01	0.0	0.0
2.0000E 01	2.6800E 00	----------+	1.6050E 01	7.1963E-02	0.0
2.5000E 01	2.5961E 00	----------+	1.6061E 01	5.2524E-01	0.0
3.0000E 01	2.5265E 00	---------+	1.6071E 01	9.0538E-01	3.9000E 03
3.5000E 01	1.1462E 01	----------+	1.6126E 01	0.0	3.9000E 03
4.0000E 01	9.1831E 00	----------+	1.6179E 01	0.0	3.9000E 03
4.5000E 01	5.8217E 00	----------+	1.6205E 01	7.5673E 00	3.9000E 03
5.0000E 01	3.3239E 00	----------+	1.6156E 01	2.0211E 01	1.9500E 03
5.5000E 01	1.4069E 00	-------+	1.6045E 01	2.9347E 01	1.9500E 03
6.0000E 01	1.4009E 00	------+	1.5894E 01	3.3289E 01	1.9500E 03
6.5000E 01	1.3124E 00	-----+	1.5732E 01	3.4089E 01	1.9500E 03
7.0000E 01	1.3938E 00	-----+	1.5569E 01	3.3364E 01	1.9500E 03
7.5000E 01	1.5296E 00	-----+	1.5413E 01	3.2040E 01	1.9500E 03
8.0000E 01	1.6694E 00	------+	1.5264E 01	3.0594E 01	1.9500E 03
8.5000E 01	1.7687E 00	------+	1.5123E 01	2.9237E 01	1.9500E 03
9.0000E 01	1.8854E 00	-------+	1.4989E 01	2.8040E 01	1.9500E 03
9.5000E 01	1.9593E 00	-------+	1.4861E 01	2.7013E 01	1.9500E 03
1.0000E 02	2.0143E 00	-------+	1.4739E 01	2.6134E 01	1.9500E 03
1.0500E 02	2.0554E 00	-------+	1.4620E 01	2.5376E 01	1.9500E 03
1.1000E 02	2.0810E 00	--------+	1.4505E 01	2.4714E 01	1.9500E 03
1.1500E 02	2.0945E 00	--------+	1.4394E 01	2.4126E 01	1.9500E 03
1.2000E 02	2.1113E 00	--------+	1.4285E 01	2.3592E 01	1.9500E 03
1.2500E 02	2.1180E 00	--------+	1.4179E 01	2.3100E 01	1.9500E 03
1.3000E 02	2.1209E 00	--------+	1.4075E 01	2.2640E 01	1.9500E 03
1.3500E 02	2.1209E 00	--------+	1.3973E 01	2.2205E 01	1.9500E 03
1.4000E 02	2.1186E 00	--------+	1.3874E 01	2.1787E 01	1.9500E 03
1.4500E 02	2.1145E 00	--------+	1.3777E 01	2.1385E 01	1.9500E 03
1.5000E 02	2.1090E 00	--------+	1.3681E 01	2.0996E 01	1.9500E 03
1.5500E 02	2.1022E 00	--------+	1.3588E 01	2.0617E 01	1.9500E 03
1.6000E 02	2.0945E 00	--------+	1.3496E 01	2.0248E 01	1.9500E 03
1.6500E 02	2.0860E 00	--------+	1.3406E 01	1.9887E 01	0.0
1.7000E 02	1.0203E 00	---+	1.3313E 01	2.0415E 01	0.0
1.7500E 02	4.5645E-01	-+	1.3212E 01	2.1312E 01	0.0
1.8000E 02	3.0932E-01	+	1.3104E 01	2.3388E 01	0.0
1.8500E 02	2.5992E-01	+	1.2979E 01	2.6924E 01	0.0
1.9000E 02	2.3143E-01	+	1.2840E 01	2.7736E 01	0.0
1.9500E 02	3.9070E-01	+	1.2724E 01	1.8830E 01	0.0
2.0000E 02	6.1125E-01	-+	1.2655E 01	1.0375E 01	0.0
2.0500E 02	8.3096E-01	--+	1.2623E 01	4.0785E 00	0.0
2.1000E 02	1.0184E 00	---+	1.2616E 01	0.0	0.0
2.1500E 02	1.2096E 00	----+	1.2624E 01	0.0	0.0
2.2000E 02	1.4066E 00	-----+	1.2630E 01	0.0	0.0
2.2500E 02	1.5952E 00	-----+	1.2638E 01	0.0	0.0
2.3000E 02	1.7719E 00	------+	1.2646E 01	0.0	0.0
2.3500E 02	1.9337E 00	-------+	1.2656E 01	0.0	0.0
2.4000E 02	2.0798E 00	--------+	1.2666E 01	0.0	0.0
2.4500E 02	2.2105E 00	--------+	1.2676E 01	0.0	0.0
2.5000E 02	2.3266E 00	---------+	1.2688E 01	0.0	0.0

FIGURE 22a (1) INSULIN LOAD TEST (3900, 1950 ng/min)

MINIMUM 4.3571E-01 GCIIL VERSUS TIME MAXIMUM 1.0829E 00

TIME	GCIIL	I	GR22L2	GR22L3	GR22L4
0.0	1.0000E 00	----------+	3.9815E 01	7.1478E 00	2.7800E 00
5.0000E 00	1.0003E 00	----------+	1.8471E 01	7.4460E 00	2.7800E 00
1.0000E 01	1.0827E 00	----------+	1.0541E 01	7.0939E 00	2.7800E 00
1.5000E 01	1.0797E 00	----------+	7.6466E 00	6.9333E 00	2.7800E 00
2.0000E 01	1.0752E 00	----------+	6.5001E 00	6.8791E 00	2.7800E 00
2.5000E 01	1.0712E 00	----------+	6.0698E 00	6.6747E 00	2.7800E 00
3.0000E 01	1.0679E 00	----------+	5.9505E 00	6.8913E 00	2.7800E 00
3.5000E 01	1.0317E 00	----------+	8.9794E-01	6.0685E 00	2.7800E 00
4.0000E 01	9.2652E-01	----------+	1.1406E 00	6.5440E 00	2.7800E 00
4.5000E 01	7.6607E-01	----------+	1.8908E 00	7.3837E 00	2.7800E 00
5.0000E 01	6.3757E-01	----------+	3.2183E 00	8.1834E 00	2.7800E 00
5.5000E 01	5.6650E-01	----------+	4.7734E 00	8.7746E 00	2.7800E 00
6.0000E 01	5.2466E-01	----------+	6.0986E 00	9.1266E 00	2.7800E 00
6.5000E 01	5.1249E-01	----------+	7.0014E 00	9.3170E 00	2.7800E 00
7.0000E 01	5.0929E-01	----------+	7.5379E 00	9.4134E 00	2.7800E 00
7.5000E 01	5.0926E-01	----------+	7.8284E 00	9.4596E 00	2.7800E 00
8.0000E 01	5.0911E-01	----------+	7.9769E 00	9.4821E 00	2.7800E 00
8.5000E 01	5.0840E-01	----------+	8.0543E 00	9.4957E 00	2.7800E 00
9.0000E 01	5.0667E-01	----------+	8.1029E 00	9.5076E 00	2.7800E 00
9.5000E 01	5.0399E-01	----------+	8.1453E 00	9.5217E 00	2.7800E 00
1.0000E 02	5.0052E-01	----------+	8.1920E 00	9.5387E 00	2.7800E 00
1.0500E 02	4.9647E-01	----------+	8.2469E 00	9.5587E 00	2.7800E 00
1.1000E 02	4.9199E-01	----------+	8.3102E 00	9.5812E 00	2.7800E 00
1.1500E 02	4.8722E-01	----------+	8.3810E 00	9.6056E 00	2.7800E 00
1.2000E 02	4.8227E-01	----------+	8.4576E 00	9.6314E 00	2.7800E 00
1.2500E 02	4.7722E-01	----------+	8.5387E 00	9.6581E 00	2.7800E 00
1.3000E 02	4.7211E-01	----------+	8.6227E 00	9.6853E 00	2.7800E 00
1.3500E 02	4.6697E-01	----------+	8.7086E 00	9.7127E 00	2.7800E 00
1.4000E 02	4.6184E-01	----------+	8.7954E 00	9.7402E 00	2.7800E 00
1.4500E 02	4.5683E-01	----------+	8.8825E 00	9.7675E 00	2.7800E 00
1.5000E 02	4.5196E-01	----------+	8.9696E 00	9.7945E 00	2.7800E 00
1.5500E 02	4.4686E-01	----------+	9.0561E 00	9.8213E 00	2.7800E 00
1.6000E 02	4.4197E-01	----------+	9.1418E 00	9.8476E 00	2.7800E 00
1.6500E 02	4.3716E-01	----------+	9.2267E 00	9.8736E 00	2.7800E 00
1.7000E 02	4.3265E-01	----------+	1.0871E 01	1.0090E 01	2.7800E 00
1.7500E 02	4.8106E-01	----------+	2.7270E 01	1.0755E 01	2.7800E 00
1.8000E 02	5.6692E-01	----------+	4.4420E 01	1.1552E 01	2.7800E 00
1.8500E 02	6.5993E-01	----------+	4.6882E 01	1.1993E 01	2.7800E 00
1.9000E 02	7.4389E-01	----------+	4.2207E 01	1.1934E 01	2.7800E 00
1.9500E 02	8.0027E-01	----------+	3.5801E 01	1.1278E 01	2.7800E 00
2.0000E 02	8.3465E-01	----------+	3.0285E 01	1.0672E 01	2.7800E 00
2.0500E 02	8.5657E-01	----------+	2.6196E 01	1.0211E 01	2.7800E 00
2.1000E 02	8.7115E-01	----------+	2.3535E 01	9.8779E 00	2.7800E 00
2.1500E 02	8.8562E-01	----------+	2.1291E 01	9.5994E 00	2.7800E 00
2.2000E 02	8.9975E-01	----------+	1.9656E 01	9.3517E 00	2.7800E 00
2.2500E 02	9.1221E-01	----------+	1.8286E 01	9.1360E 00	2.7800E 00
2.3000E 02	9.2322E-01	----------+	1.7119E 01	8.9492E 00	2.7800E 00
2.3500E 02	9.3287E-01	----------+	1.6120E 01	8.7880E 00	2.7800E 00
2.4000E 02	9.4133E-01	----------+	1.5263E 01	8.6489E 00	2.7800E 00
2.4500E 02	9.4873E-01	----------+	1.4527E 01	8.5288E 00	2.7800E 00
2.5000E 02	9.5521E-01	----------+	1.3894E 01	8.4249E 00	2.7800E 00

FIGURE 22a (2) INSULIN LOAD TEST (3900, 1950 ng/min)

MINIMUM 4.2130E-03 — SE3M VERSUS TIME — MAXIMUM 1.6480E 02

TIME	SE3M	1	I	EW3M	GK23M	IC2M
0.0	1.2907E 00	+		0.0	1.2907E 00	5.0000E-01
5.0000E 00	3.5585E-01	+		2.9979E 00	3.4229E-01	2.9403E-01
1.0000E 01	2.6806E-01	+		4.4864E 00	2.5354E-01	2.6077E-01
1.5000E 01	2.4428E-01	+		5.7541E 00	2.2987E-01	2.5074E-01
2.0000E 01	2.3294E-01	+		6.9457E 00	2.1801E-01	2.4548E-01
2.5000E 01	2.2390E-01	+		8.0874E 00	2.0926E-01	2.4150E-01
3.0000E 01	2.1621E-01	+		9.1873E 00	2.0221E-01	2.3821E-01
3.5000E 01	8.0096E 01	----------+		1.3956E 02	8.1062E 01	2.6192E 00
4.0000E 01	1.6401E 02	----------+		8.0364E 02	2.4831E 02	4.0986E 00
4.5000E 01	1.3967E 02	----------+		1.5841E 03	3.7063E 02	4.8106E 00
5.0000E 01	1.0250E 02	----------+		2.1619E 03	4.3490E 02	5.1265E 00
5.5000E 01	5.4159E 01	----------+		2.5549E 03	2.4687E 02	4.0690E 00
6.0000E 01	3.9435E 01	----------+		2.7830E 03	1.5749E 02	3.4161E 00
6.5000E 01	3.3801E 01	----------+		2.9641E 03	1.2079E 02	3.0722E 00
7.0000E 01	3.1550E 01	----------+		3.1286E 03	1.0437E 02	2.8976E 00
7.5000E 01	3.0670E 01	----------+		3.2816E 03	9.6606E 01	2.8096E 00
8.0000E 01	3.0404E 01	----------+		3.4344E 03	9.2819E 01	2.7656E 00
8.5000E 01	3.0329E 01	----------+		3.5861E 03	9.0939E 01	2.7424E 00
9.0000E 01	3.0284E 01	----------+		3.7377E 03	8.9996E 01	2.7311E 00
9.5000E 01	3.0205E 01	----------+		3.8889E 03	8.9525E 01	2.7253E 00
1.0000E 02	3.0075E 01	----------+		4.0396E 03	8.9286E 01	2.7224E 00
1.0500E 02	2.9895E 01	----------+		4.1894E 03	8.9166E 01	2.7209E 00
1.1000E 02	2.9674E 01	----------+		4.3382E 03	8.9105E 01	2.7202E 00
1.1500E 02	2.9422E 01	----------+		4.4857E 03	8.9075E 01	2.7198E 00
1.2000E 02	2.9149E 01	----------+		4.6320E 03	8.9059E 01	2.7196E 00
1.2500E 02	2.8861E 01	----------+		4.7768E 03	8.9052E 01	2.7195E 00
1.3000E 02	2.8564E 01	----------+		4.9202E 03	8.9043E 01	2.7195E 00
1.3500E 02	2.8263E 01	----------+		5.0621E 03	8.9046E 01	2.7195E 00
1.4000E 02	2.7960E 01	----------+		5.2025E 03	8.9046E 01	2.7194E 00
1.4500E 02	2.7657E 01	----------+		5.3413E 03	8.9046E 01	2.7194E 00
1.5000E 02	2.7355E 01	----------+		5.4787E 03	8.9046E 01	2.7194E 00
1.5500E 02	2.7055E 01	----------+		5.6145E 03	8.9046E 01	2.7194E 00
1.6000E 02	2.6759E 01	----------+		5.7488E 03	8.9046E 01	2.7194E 00
1.6500E 02	2.6466E 01	----------+		5.8817E 03	8.9046E 01	2.7194E 00
1.7000E 02	6.8889E 00	--+		5.9608E 03	2.1357E 01	1.5362E 00
1.7500E 02	1.4636E 00	+		5.9783E 03	3.9353E 00	7.3096E-01
1.8000E 02	3.1163E-01	+		5.9818E 03	7.1728E-01	3.9529E-01
1.8500E 02	6.6614E-02	+		5.9824E 03	1.3036E-01	1.9985E-01
1.9000E 02	1.4072E-02	+		5.9824E 03	2.3707E-02	1.0106E-01
1.9500E 02	4.7917E-03	+		5.9824E 03	7.1360E-03	6.2520E-02
2.0000E 02	4.5447E-03	+		5.9824E 03	6.1828E-03	5.9039E-02
2.0500E 02	6.8246E-03	+		5.9824E 03	8.7140E-03	6.7721E-02
2.1000E 02	1.0426E-02	+		5.9824E 03	1.2745E-02	7.8844E-02
2.1500E 02	1.4739E-02	+		5.9824E 03	1.7464E-02	8.9432E-02
2.2000E 02	1.9644E-02	+		5.9824E 03	2.2943E-02	9.9745E-02
2.2500E 02	2.5006E-02	+		5.9824E 03	2.9012E-02	1.0956E-01
2.3000E 02	3.1775E-02	+		5.9824E 03	3.5397E-02	1.1864E-01
2.3500E 02	3.8107E-02	+		5.9824E 03	4.1843E-02	1.2685E-01
2.4000E 02	4.4396E-02	+		5.9824E 03	4.8152E-02	1.3416E-01
2.4500E 02	5.0492E-02	+		5.9824E 03	5.4186E-02	1.4067E-01
2.5000E 02	5.6292E-02	+		5.9824E 03	5.9860E-02	1.4638E-01

FIGURE 22b (1) INSULIN LOAD TEST (3900, 1950 ng/min)

MINIMUM 4.3257E-01 GCIL VERSUS TIME MAXIMUM 1.0778E 00

TIME	GCIL	I	ICIL	ACIL
0.0	1.0000E 00	----------+	5.0000E-01	6.0000E-02
5.0000E 00	1.0750E 00	----------+	9.3466E-01	8.3304E-02
1.0000E 01	1.0777E 00	----------+	9.2332E-01	7.4026E-02
1.5000E 01	1.0756E 00	----------+	9.0694E-01	6.9602E-02
2.0000E 01	1.0708E 00	----------+	8.9502E-01	6.7856E-02
2.5000E 01	1.0669E 00	----------+	8.8286E-01	6.7386E-02
3.0000E 01	1.0637E 00	----------+	8.7263E-01	6.7484E-02
3.5000E 01	1.0174E 00	----------+	9.1538E 00	7.1617E-02
4.0000E 01	9.1504E-01	----------+	1.1417E 01	8.5496E-02
4.5000E 01	7.6045E-01	----------+	1.2322E 01	1.1125E-01
5.0000E 01	6.3540E-01	----------+	1.2746E 01	1.3742E-01
5.5000E 01	5.5744E-01	----------+	8.8187E 00	1.5794E-01
6.0000E 01	5.2336E-01	----------+	7.7237E 00	1.7086E-01
6.5000E 01	5.1078E-01	----------+	7.1756E 00	1.7771E-01
7.0000E 01	5.0719E-01	----------+	6.8991E 00	1.8132E-01
7.5000E 01	5.0603E-01	----------+	6.7594E 00	1.8307E-01
8.0000E 01	5.0543E-01	----------+	6.6889E 00	1.8392E-01
8.5000E 01	5.0503E-01	----------+	6.6532E 00	1.8443E-01
9.0000E 01	5.0365E-01	----------+	6.6352E 00	1.8489E-01
9.5000E 01	5.0165E-01	----------+	6.6261E 00	1.8543E-01
1.0000E 02	4.9734E-01	----------+	6.6215E 00	1.8607E-01
1.0500E 02	4.9522E-01	----------+	6.6192E 00	1.8684E-01
1.1000E 02	4.9371E-01	----------+	6.6180E 00	1.8770E-01
1.1500E 02	4.8391E-01	----------+	6.6174E 00	1.8863E-01
1.2000E 02	4.7595E-01	----------+	6.6171E 00	1.8963E-01
1.2500E 02	4.7328E-01	----------+	6.6170E 00	1.9066E-01
1.3000E 02	4.6876E-01	----------+	6.6169E 00	1.9171E-01
1.3500E 02	4.6304E-01	----------+	6.6169E 00	1.9277E-01
1.4000E 02	4.5564E-01	----------+	6.6169E 00	1.9384E-01
1.4500E 02	4.5248E-01	----------+	6.6169E 00	1.9491E-01
1.5000E 02	4.4644E-01	----------+	6.6169E 00	1.9596E-01
1.5500E 02	4.4353E-01	----------+	6.6169E 00	1.9701E-01
1.6000E 02	4.3869E-01	----------+	6.6169E 00	1.9805E-01
1.6500E 02	4.3384E-01	----------+	6.6169E 00	1.9907E-01
1.7000E 02	4.3071E-01	----------+	2.4656E 00	1.9437E-01
1.7500E 02	4.7729E-01	----------+	1.2402E 00	1.9457E-01
1.8000E 02	5.6139E-01	----------+	6.2614E-01	1.8226E-01
1.8500E 02	6.5462E-01	----------+	3.1634E-01	1.6587E-01
1.9000E 02	7.3932E-01	----------+	1.7238E-01	1.4893E-01
1.9500E 02	7.9691E-01	----------+	1.9256E-01	1.3494E-01
2.0000E 02	8.3222E-01	----------+	2.4081E-01	1.2486E-01
2.0500E 02	8.5434E-01	----------+	2.8873E-01	1.1783E-01
2.1000E 02	8.6865E-01	----------+	3.2882E-01	1.1298E-01
2.1500E 02	8.8322E-01	----------+	3.6689E-01	1.0907E-01
2.2000E 02	8.9664E-01	----------+	4.0383E-01	1.0563E-01
2.2500E 02	9.0907E-01	----------+	4.3792E-01	1.0263E-01
2.3000E 02	9.1964E-01	----------+	4.6869E-01	1.0000E-01
2.3500E 02	9.2927E-01	----------+	4.9609E-01	9.7702E-02
2.4000E 02	9.3752E-01	----------+	5.2030E-01	9.5687E-02
2.4500E 02	9.4473E-01	----------+	5.4162E-01	9.3924E-02
2.5000E 02	9.5105E-01	----------+	5.6034E-01	9.2379E-02

FIGURE 22b (2) INSULIN LOAD TEST (3900, 1950 ng/min)

(6) 22c1

MINIMUM 3.5022E-01 GCIM VERSUS TIME MAXIMUM 1.0710E 00

TIME	GCIM	I	ICIM	ACIM	GC2M
0.0	1.0000E 00	+	5.0000E-01	6.0000E-02	1.0000E 00
5.0000E 00	1.0444E 00	+	3.4391E-01	3.6448E-02	1.0250E 00
1.0000E 01	1.0818E 00	+	3.1071E-01	2.7986E-02	1.0494E 00
1.5000E 01	1.0888E 00	+	2.9997E-01	2.4372E-02	1.0627E 00
2.0000E 01	1.0769E 00	+	2.9396E-01	2.2765E-02	1.0685E 00
2.5000E 01	1.0705E 00	+	2.8924E-01	2.2111E-02	1.0700E 00
3.0000E 01	1.0589E 00	+	2.8543E-01	2.1908E-02	1.0693E 00
3.5000E 01	1.0221E 00	+	3.4288E 00	2.2333E-02	9.8611E-01
4.0000E 01	7.9992E-01	+	5.0612E 00	2.4560E-02	6.6049E-01
4.5000E 01	5.5097E-01	+	5.8361E 00	3.0214E-02	3.7467E-01
5.0000E 01	4.0586E-01	+	6.1642E 00	3.8042E-02	2.3569E-01
5.5000E 01	3.5157E-01	+	4.7782E 00	4.5656E-02	2.1951E-01
6.0000E 01	3.5527E-01	+	4.0330E 00	5.1494E-02	2.5040E-01
6.5000E 01	3.6872E-01	+	3.6529E 00	5.5272E-02	2.7984E-01
7.0000E 01	3.8160E-01	+	3.4603E 00	5.7465E-02	3.0211E-01
7.5000E 01	3.9146E-01	+	3.3628E 00	5.8639E-02	3.1756E-01
8.0000E 01	3.9802E-01	+	3.3136E 00	5.9236E-02	3.2757E-01
8.5000E 01	4.0169E-01	+	3.2887E 00	5.9546E-02	3.3351E-01
9.0000E 01	4.0307E-01	+	3.2762E 00	5.9741E-02	3.3650E-01
9.5000E 01	4.0274E-01	+	3.2698E 00	5.9911E-02	3.3740E-01
1.0000E 02	4.0117E-01	+	3.2666E 00	6.0093E-02	3.3683E-01
1.0500E 02	3.9871E-01	+	3.2650E 00	6.0317E-02	3.3527E-01
1.1000E 02	3.9584E-01	+	3.2641E 00	6.0570E-02	3.3302E-01
1.1500E 02	3.9286E-01	+	3.2637E 00	6.0853E-02	3.3031E-01
1.2000E 02	3.8842E-01	+	3.2635E 00	6.1156E-02	3.2730E-01
1.2500E 02	3.8450E-01	+	3.2634E 00	6.1481E-02	3.2410E-01
1.3000E 02	3.8094E-01	+	3.2634E 00	6.1814E-02	3.2078E-01
1.3500E 02	3.7843E-01	+	3.2633E 00	6.2155E-02	3.1740E-01
1.4000E 02	3.7237E-01	+	3.2633E 00	6.2495E-02	3.1394E-01
1.4500E 02	3.6831E-01	+	3.2633E 00	6.2844E-02	3.1059E-01
1.5000E 02	3.6426E-01	+	3.2633E 00	6.3188E-02	3.0720E-01
1.5500E 02	3.6029E-01	+	3.2633E 00	6.3530E-02	3.0384E-01
1.6000E 02	3.5635E-01	+	3.2633E 00	6.3869E-02	3.0051E-01
1.6500E 02	3.5246E-01	+	3.2633E 00	6.4203E-02	2.9722E-01
1.7000E 02	3.4865E-01	+	1.6934E 00	6.4483E-02	3.2256E-01
1.7500E 02	4.0842E-01	+	8.6272E-01	6.4055E-02	3.7196E-01
1.8000E 02	4.7809E-01	+	4.3656E-01	6.1757E-02	4.3440E-01
1.8500E 02	5.6044E-01	+	2.2070E-01	5.7592E-02	5.1099E-01
1.9000E 02	6.4377E-01	+	1.1180E-01	5.2475E-02	5.9350E-01
1.9500E 02	7.1496E-01	+	7.2838E-02	4.7425E-02	6.7148E-01
2.0000E 02	7.6662E-01	+	7.1556E-02	4.3293E-02	7.3500E-01
2.0500E 02	8.0600E-01	+	8.2789E-02	4.0220E-02	7.8310E-01
2.1000E 02	8.3604E-01	+	9.6145E-02	3.8035E-02	8.1802E-01
2.1500E 02	8.5803E-01	+	1.0879E-01	3.6447E-02	8.4398E-01
2.2000E 02	8.7663E-01	+	1.2112E-01	3.5156E-02	8.6496E-01
2.2500E 02	8.9253E-01	+	1.3281E-01	3.4056E-02	8.8259E-01
2.3000E 02	9.0625E-01	+	1.4358E-01	3.3100E-02	8.9766E-01
2.3500E 02	9.1814E-01	+	1.5331E-01	3.2265E-02	9.1070E-01
2.4000E 02	9.2849E-01	+	1.6198E-01	3.1535E-02	9.2199E-01
2.4500E 02	9.3750E-01	+	1.6965E-01	3.0896E-02	9.3182E-01
2.5000E 02	9.4537E-01	+	1.7641E-01	3.0336E-02	9.4039E-01

FIGURE 22c (1) INSULIN LOAD TEST (3900, 1950 ng/min)

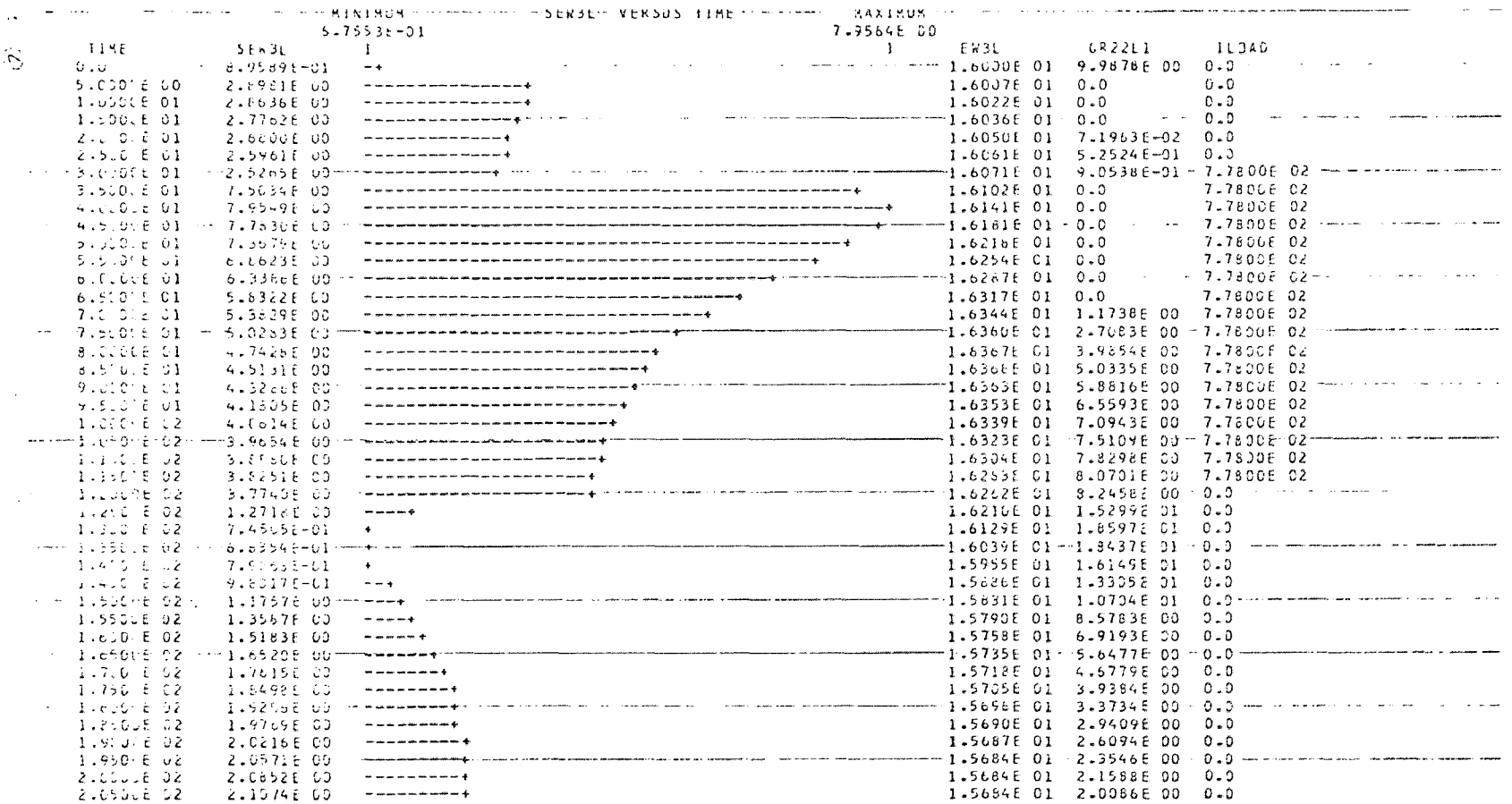
(6) 224

GRDELT VERSUS TIME

MINIMUM -1.7963E 02 I — MAXIMUM 7.1569E 01 I

TIME	GRDELT	GRIN	GRDUT	GCIR
0.0	4.0794E 01	6.5981E 01	2.5187E 01	1.0000E 00
5.0000E 00	8.6965E 00	3.4947E 01	2.6249E 01	1.0828E 00
1.0000E 01	5.3569E-01	2.6665E 01	2.6136E 01	1.0830E 00
1.5000E 01	-2.4105E 00	2.3610E 01	2.6020E 01	1.0795E 00
2.0000E 01	-3.4317E 00	2.2481E 01	2.5913E 01	1.0748E 00
2.5000E 01	-3.3202E 00	2.2500E 01	2.5820E 01	1.0709E 00
3.0000E 01	-2.9654E 00	2.2777E 01	2.5743E 01	1.0676E 00
3.5000E 01	-9.8564E 01	1.5996E 01	1.1456E 02	1.0276E 00
4.0000E 01	-1.7948E 02	1.6715E 01	1.9619E 02	9.1529E-01
4.5000E 01	-1.4182E 02	2.5872E 01	1.6769E 02	7.5225E-01
5.0000E 01	-8.6186E 01	4.0643E 01	1.2683E 02	6.2673E-01
5.5000E 01	-2.7171E 01	5.1925E 01	7.9096E 01	5.5221E-01
6.0000E 01	-6.2914E 00	5.7544E 01	6.3836E 01	5.2189E-01
6.5000E 01	1.3241E 00	5.9438E 01	5.8114E 01	5.1147E-01
7.0000E 01	3.4205E 00	5.9345E 01	5.5924E 01	5.0902E-01
7.5000E 01	3.1505E 00	5.8356E 01	5.5208E 01	5.0903E-01
8.0000E 01	2.0107E 00	5.7083E 01	5.5079E 01	5.0906E-01
8.5000E 01	6.9968E-01	5.5817E 01	5.5116E 01	5.0831E-01
9.0000E 01	-4.8862E-01	5.4681E 01	5.5170E 01	5.0650E-01
9.5000E 01	-1.4552E 00	5.3710E 01	5.5165E 01	5.0373E-01
1.0000E 02	-2.1946E 00	5.2894E 01	5.5089E 01	5.0020E-01
1.0500E 02	-2.7363E 00	5.2214E 01	5.4948E 01	4.9605E-01
1.1000E 02	-3.1150E 00	5.1636E 01	5.4754E 01	4.9156E-01
1.1500E 02	-3.3794E 00	5.1142E 01	5.4522E 01	4.8679E-01
1.2000E 02	-3.5490E 00	5.0711E 01	5.4260E 01	4.8182E-01
1.2500E 02	-3.6522E 00	5.0327E 01	5.3979E 01	4.7675E-01
1.3000E 02	-3.7071E 00	4.9976E 01	5.3685E 01	4.7164E-01
1.3500E 02	-3.7276E 00	4.9656E 01	5.3383E 01	4.6652E-01
1.4000E 02	-3.7257E 00	4.9352E 01	5.3078E 01	4.6143E-01
1.4500E 02	-3.7057E 00	4.9065E 01	5.2771E 01	4.5637E-01
1.5000E 02	-3.6736E 00	4.8790E 01	5.2464E 01	4.5136E-01
1.5500E 02	-3.6326E 00	4.8525E 01	5.2157E 01	4.4641E-01
1.6000E 02	-3.5863E 00	4.8267E 01	5.1853E 01	4.4153E-01
1.6500E 02	-3.5356E 00	4.8017E 01	5.1552E 01	4.3672E-01
1.7000E 02	1.9497E 01	5.0406E 01	3.0909E 01	4.4044E-01
1.7500E 02	4.3451E 01	6.8368E 01	2.4916E 01	4.8649E-01
1.8000E 02	6.4769E 01	8.8390E 01	2.3621E 01	5.7481E-01
1.8500E 02	7.1503E 01	9.4830E 01	2.3327E 01	6.6820E-01
1.9000E 02	6.7601E 01	9.0907E 01	2.3245E 01	7.5113E-01
1.9500E 02	5.1544E 01	7.4939E 01	2.3395E 01	8.0501E-01
2.0000E 02	3.6746E 01	6.0362E 01	2.3616E 01	8.3782E-01
2.0500E 02	2.5677E 01	4.9515E 01	2.3638E 01	8.5557E-01
2.1000E 02	1.8214E 01	4.2243E 01	2.4029E 01	8.7245E-01
2.1500E 02	1.5696E 01	3.9920E 01	2.4224E 01	8.8716E-01
2.2000E 02	1.3612E 01	3.8038E 01	2.4426E 01	9.0099E-01
2.2500E 02	1.1631E 01	3.6452E 01	2.4621E 01	9.1333E-01
2.3000E 02	1.0295E 01	3.5099E 01	2.4804E 01	9.2420E-01
2.3500E 02	8.9660E 00	3.3938E 01	2.4972E 01	9.3373E-01
2.4000E 02	7.8173E 00	3.2942E 01	2.5124E 01	9.4208E-01
2.4500E 02	6.8246E 00	3.2086E 01	2.5261E 01	9.4939E-01
2.5000E 02	5.9664E 00	3.1349E 01	2.5383E 01	9.5579E-01

FIGURE 22c (2) INSULIN LOAD TEST (3900, 1950 ng/min)



SEW3L VERSUS TIME

MINIMUM 5.7553E-01 MAXIMUM 7.9564E 00

TIME	SEW3L	EW3L	GR22L1	ILOAD
0.0	8.9589E-01	1.6030E 01	9.9878E 00	0.0
5.0300E 00	2.8981E 00	1.6007E 01	0.0	0.0
1.0050E 01	2.8636E 00	1.6022E 01	0.0	0.0
1.5000E 01	2.7762E 00	1.6036E 01	0.0	0.0
2.0 0.E 01	2.6800E 00	1.6050E 01	7.1963E-02	0.0
2.5.0 E 01	2.5961E 00	1.6061E 01	5.2524E-01	0.0
3.0050E 01	2.5205E 00	1.6071E 01	9.0538E-01	7.7800E 02
3.5000E 01	7.5034E 00	1.6102E 01	0.0	7.7800E 02
4.0000E 01	7.9549E 00	1.6141E 01	0.0	7.7800E 02
4.5.00E 01	7.7830E 00	1.6181E 01	0.0	7.7800E 02
5.0000E 01	7.5679E 00	1.6218E 01	0.0	7.7800E 02
5.5.0 E 01	6.8623E 00	1.6254E 01	0.0	7.7800E 02
6.0000E 01	6.3386E 00	1.6287E 01	0.0	7.7800E 02
6.5100E 01	5.8322E 00	1.6317E 01	0.0	7.7800E 02
7.0 00E 01	5.3829E 00	1.6344E 01	1.1738E 00	7.7800E 02
7.5000E 01	5.0283E 00	1.6360E 01	2.7083E 00	7.7800E 02
8.0000E 01	4.7426E 00	1.6367E 01	3.9854E 00	7.7800E 02
8.5100E 01	4.5131E 00	1.6368E 01	5.0335E 00	7.7800E 02
9.0100E 01	4.3226E 00	1.6363E 01	5.8816E 00	7.7800E 02
9.5.00E 01	4.1305E 00	1.6353E 01	6.5593E 00	7.7800E 02
1.0000E 02	4.0014E 00	1.6339E 01	7.0943E 00	7.7800E 02
1.0500E 02	3.9654E 00	1.6323E 01	7.5109E 00	7.7800E 02
1.1.00E 02	3.8756E 00	1.6304E 01	7.8298E 00	7.7800E 02
1.1500E 02	3.8251E 00	1.6283E 01	8.0701E 00	7.7800E 02
1.2000E 02	3.7745E 00	1.6262E 01	8.2458E 00	0.0
1.2.0E 02	1.2716E 00	1.6210E 01	1.5299E 01	0.0
1.3.00 E 02	7.4655E-01	1.6129E 01	1.8597E 01	0.0
1.350E 02	6.8854E-01	1.6039E 01	1.8437E 01	0.0
1.4.00 E 02	7.9[illegible]E-01	1.5955E 01	1.6149E 01	0.0
1.4.0 E 02	9.8017E-01	1.5886E 01	1.3305E 01	0.0
1.500 E 02	1.1757E 00	1.5831E 01	1.0704E 01	0.0
1.5500E 02	1.3567E 00	1.5790E 01	8.5783E 00	0.0
1.6000E 02	1.5183E 00	1.5758E 01	6.9193E 00	0.0
1.6500E 02	1.6520E 00	1.5735E 01	5.6477E 00	0.0
1.7.0 E 02	1.7615E 00	1.5718E 01	4.6779E 00	0.0
1.750 E 02	1.8499E 00	1.5705E 01	3.9384E 00	0.0
1.800 E 02	1.9205E 00	1.5696E 01	3.3734E 00	0.0
1.8500E 02	1.9769E 00	1.5690E 01	2.9409E 00	0.0
1.9.00 E 02	2.0216E 00	1.5687E 01	2.6094E 00	0.0
1.950 E 02	2.0571E 00	1.5684E 01	2.3546E 00	0.0
2.0000E 02	2.0852E 00	1.5684E 01	2.1588E 00	0.0
2.0500E 02	2.1074E 00	1.5684E 01	2.0086E 00	0.0
2.1000E 02	2.1251E 00	1.5684E 01	1.8936E 00	0.0

FIGURE 23a (1) INSULIN LOAD TEST (778 ng/min)

MINIMUM 7.6826E-01 — GC11L VERSUS TIME — MAXIMUM 1.0829E 00

TIME	GC11L	I	I	GR22L2	GR22L3	GR22L4
0.0	1.0000E 00			3.9815E 01	7.1478E 00	2.7800E 00
5.0000E 00	1.0000E 00			1.8471E 01	7.4460E 00	2.7800E 00
1.0000E 01	1.0827E 00			1.0541E 01	7.0939E 00	2.7800E 00
1.5000E 01	1.0797E 00			7.6466E 00	6.9333E 00	2.7800E 00
2.0000E 01	1.0752E 00			6.5001E 00	6.8791E 00	2.7800E 00
2.5000E 01	1.0712E 00			6.0698E 00	6.8747E 00	2.7800E 00
3.0000E 01	1.0679E 00			5.9505E 00	6.8913E 00	2.7800E 00
3.5000E 01	1.0505E 00			2.5817E 00	6.1144E 00	2.7800E 00
4.0000E 01	1.0281E 00			1.7262E 00	6.1881E 00	2.7800E 00
4.5000E 01	1.0026E 00			1.6292E 00	6.3298E 00	2.7800E 00
5.0000E 01	9.7596E-01			1.7649E 00	6.5011E 00	2.7800E 00
5.5000E 01	9.4093E-01			2.0149E 00	6.6848E 00	2.7800E 00
6.0000E 01	9.2285E-01			2.3384E 00	6.8096E 00	2.7800E 00
6.5000E 01	8.9810E-01			2.7124E 00	7.0485E 00	2.7800E 00
7.0000E 01	8.7639E-01			3.1171E 00	7.2132E 00	2.7800E 00
7.5000E 01	8.5910E-01			3.5176E 00	7.3523E 00	2.7800E 00
8.0000E 01	8.4433E-01			3.8905E 00	7.4691E 00	2.7800E 00
8.5000E 01	8.3306E-01			4.2270E 00	7.5667E 00	2.7800E 00
9.0000E 01	8.2313E-01			4.5249E 00	7.6401E 00	2.7800E 00
9.5000E 01	8.1486E-01			4.7852E 00	7.7162E 00	2.7800E 00
1.0000E 02	8.0786E-01			5.0113E 00	7.7734E 00	2.7800E 00
1.0500E 02	8.0191E-01			5.2073E 00	7.8217E 00	2.7800E 00
1.1000E 02	7.9678E-01			5.3774E 00	7.8629E 00	2.7800E 00
1.1500E 02	7.9233E-01			5.5254E 00	7.8982E 00	2.7800E 00
1.2000E 02	7.8841E-01			5.6550E 00	7.9290E 00	2.7800E 00
1.2500E 02	8.1085E-01			1.3994E 01	8.6264E 00	2.7800E 00
1.3000E 02	8.5564E-01			2.0154E 01	8.9925E 00	2.7800E 00
1.3500E 02	8.9865E-01			2.0471E 01	8.9915E 00	2.7800E 00
1.4000E 02	9.3282E-01			1.8492E 01	8.7791E 00	2.7800E 00
1.4500E 02	9.5698E-01			1.6200E 01	8.5111E 00	2.7800E 00
1.5000E 02	9.7514E-01			1.4216E 01	8.2622E 00	2.7800E 00
1.5500E 02	9.8863E-01			1.2659E 01	8.0550E 00	2.7800E 00
1.6000E 02	9.9681E-01			1.1477E 01	7.8901E 00	2.7800E 00
1.6500E 02	1.0086E 00			1.0591E 01	7.7610E 00	2.7800E 00
1.7000E 02	1.0136E 00			9.9247E 00	7.6606E 00	2.7800E 00
1.7500E 02	1.0174E 00			9.4216E 00	7.5824E 00	2.7800E 00
1.8000E 02	1.0211E 00			9.0388E 00	7.5214E 00	2.7800E 00
1.8500E 02	1.0240E 00			8.7448E 00	7.4735E 00	2.7800E 00
1.9000E 02	1.0263E 00			8.5172E 00	7.4358E 00	2.7800E 00
1.9500E 02	1.0282E 00			8.3396E 00	7.4059E 00	2.7800E 00
2.0000E 02	1.0297E 00			8.2000E 00	7.3821E 00	2.7800E 00
2.0500E 02	1.0309E 00			8.0895E 00	7.3631E 00	2.7800E 00
2.1000E 02	1.0319E 00			8.0013E 00	7.3476E 00	2.7800E 00

FIGURE 23a (2) INSULIN LOAD TEST (778 ng/min)

MINIMUM SEW3M VERSUS TIME MAXIMUM

5.8303E-02 1.1475E 01

TIME	SEW3M	I	I	EW3M	GK23M	IC2M
0.0	1.2907E 00	+		0.0	1.2907E 00	5.0000E-01
5.0000E 00	3.5086E-01	-+		2.9979E 00	3.4229E-01	2.9403E-01
1.0[illegible] E 01	2.6605E-01	+		4.4864E 00	2.5354E-01	2.6077E-01
1.5[illegible] E 01	2.4922E-01	+		5.7541E 00	2.2987E-01	2.5074E-01
2.0[illegible] E 01	2.3294E-01	+		6.9457E 00	2.1601E-01	2.4945E-01
2.5[illegible] E 01	2.2[illegible]E-01	+		8.0874E 00	2.0926E-01	2.4150E-01
3.0[illegible] E 01	2.1621E-01	-+		9.1873E 00	-2.0221E-01	2.3821E-01
3.5[illegible] E 01	3.2952E 00	----------+		1.6048E 01	3.1036E 00	7.1020E-01
4.0[illegible] E 01	7.6022E 00	----------+		4.3650E 01	7.3200E 00	1.0010E 00
4.5[illegible] E 01	1.0237E 01	----------+		6.8953E 01	1.0167E 01	1.1416E 00
5.0[illegible] E 01	1.1[illegible]E 01	----------+		1.4330E 02	1.1016E 01	1.2041E 00
5.5[illegible] E 01	1.1494E 01	----------+		2.0047E 02	1.2164E 01	1.2265E 00
6.0[illegible] E 01	1.1[illegible]E 01	----------+		2.5710E 02	1.2219E 01	1.2287E 00
6.5[illegible] E 01	1.0654E 01	----------+		3.1165E 02	1.2029E 01	1.2210E 00
7.0[illegible] E 01	1.0169E 01	----------+		3.6356E 02	1.1733E 01	1.2089E 00
7.5[illegible] E 01	9.6017E 00	----------+		4.1281E 02	1.1420E 01	1.1959E 00
8.0[illegible] E 01	9.1641E 00	----------+		4.5969E 02	1.1131E 01	1.1837E 00
8.5[illegible] E 01	8.7[illegible]E 00	----------+		5.0457E 02	1.0879E 01	1.1729E 00
9.0[illegible] E 01	8.4941E 00	----------+		5.4777E 02	1.0664E 01	1.1636E 00
9.5[illegible] E 01	8.2435E 00	----------+		5.8959E 02	1.0484E 01	1.1557E 00
1.0[illegible] E 02	8.0362E 00	----------+		6.3026E 02	1.0332E 01	1.1490E 00
1.0[illegible] E 02	7.8639E 00	----------+		6.6999E 02	1.0205E 01	1.1433E 00
1.1[illegible] E 02	7.7196E 00	----------+		7.0893E 02	1.0098E 01	1.1385E 00
1.1[illegible] E 02	7.5[illegible]E 00	----------+		7.4721E 02	1.0007E 01	1.1344E 00
1.2[illegible] E 02	7.4[illegible]E 00	----------+		7.8492E 02	9.9268E 00	1.1308E 00
1.2[illegible] E 02	1.9541E 00	---------+		8.0742E 02	2.5624E 00	6.5780E-01
1.3[illegible] E 02	4.0[illegible]E-01	-+		8.1255E 02	5.9332E-01	3.6640E-01
1.3[illegible] E 02	1.5706E-01	-+		8.1393E 02	1.9058E-01	2.3263E-01
1.4[illegible] E 02	8.5[illegible]E-02	+		8.1448E 02	9.8256E-02	1.7640E-01
1.4[illegible] E 02	8.1[illegible]E-02	+		8.1484E 02	7.6695E-02	1.6154E-01
1.5[illegible] E 02	7.8[illegible]E-02	+		8.1516E 02	7.5855E-02	1.6093E-01
1.5[illegible] E 02	7.8[illegible]E-02	+		8.1554E 02	8.2364E-02	1.6631E-01
1.6[illegible] E 02	8.8529E-02	+		8.1594E 02	9.1316E-02	1.7232E-01
1.6[illegible] E 02	9.8[illegible]E-02	+		8.1640E 02	1.0052E-01	1.8011E-01
1.7[illegible] E 02	1.0[illegible]E-01	+		8.1691E 02	1.0599E-01	1.8603E-01
1.7[illegible] E 02	1.1672E-01	+		8.1746E 02	1.1635E-01	1.9096E-01
1.8[illegible] E 02	1.2[illegible]E-01	+		8.1805E 02	1.2254E-01	1.9496E-01
1.8[illegible] E 02	1.2957E-01	+		8.1867E 02	1.2766E-01	1.9818E-01
1.9[illegible] E 02	1.3435E-01	+		8.1932E 02	1.3184E-01	2.0075E-01
1.9[illegible] E 02	1.3824E-01	+		8.1999E 02	1.3523E-01	2.0280E-01
2.0[illegible] E 02	1.4140E-01	+		8.2067E 02	1.3797E-01	2.0443E-01
2.0[illegible] E 02	1.4396E-01	+		8.2138E 02	1.4020E-01	2.0574E-01
2.1[illegible] E 02	1.4604E-01	+		8.2206E 02	1.4200E-01	2.0680E-01

FIGURE 23b (1) INSULIN LOAD TEST (778 ng/min)

GCIL VERSUS TIME

MINIMUM 7.8195E-01 — MAXIMUM 1.0778E 00

TIME	GCIL		ICIL	ACIL
0.0	1.0300E 00		5.0000E-01	6.0000E-02
5.0000E 00	1.0750E 00		9.3468E-01	8.3304E-02
1.0000E 01	1.0777E 00		9.2332E-01	7.4026E-02
1.5000E 01	1.0750E 00		9.0894E-01	6.9602E-02
2.0000E 01	1.0709E 00		8.9502E-01	6.7856E-02
2.5000E 01	1.0669E 00		8.8286E-01	6.7586E-02
3.0000E 01	1.0637E 00		8.7263E-01	6.7484E-02
3.5000E 01	1.0416E 00		2.5067E 00	6.9481E-02
4.0000E 01	1.0165E 00		2.9466E 00	7.3043E-02
4.5000E 01	9.9061E-01		3.1340E 00	7.7536E-02
5.0000E 01	9.6441E-01		3.1940E 00	8.2639E-02
5.5000E 01	9.3614E-01		3.1900E 00	8.8039E-02
6.0000E 01	9.1279E-01		3.1550E 00	9.3476E-02
6.5000E 01	8.8887E-01		3.1063E 00	9.8768E-02
7.0000E 01	8.6780E-01		3.0546E 00	1.0367E-01
7.5000E 01	8.5102E-01		3.0079E 00	1.0793E-01
8.0000E 01	8.3716E-01		2.9671E 00	1.1135E-01
8.5000E 01	8.2566E-01		2.9322E 00	1.1430E-01
9.0000E 01	8.1605E-01		2.9027E 00	1.1677E-01
9.5000E 01	8.0799E-01		2.8777E 00	1.1884E-01
1.0000E 02	8.0117E-01		2.8566E 00	1.2059E-01
1.0500E 02	7.9535E-01		2.8387E 00	1.2206E-01
1.1000E 02	7.9033E-01		2.8234E 00	1.2332E-01
1.1500E 02	7.8597E-01		2.8102E 00	1.2440E-01
1.2000E 02	7.8213E-01		2.7986E 00	1.2535E-01
1.2500E 02	8.0573E-01		1.1675E 00	1.2331E-01
1.3000E 02	8.5149E-01		7.5680E-01	1.1688E-01
1.3500E 02	8.9522E-01		6.0741E-01	1.0902E-01
1.4000E 02	9.2[illegible]E-01		5.7246E-01	1.0174E-01
1.4500E 02	9.5422E-01		5.8371E-01	9.5690E-02
1.5000E 02	9.7241E-01		6.1042E-01	9.0906E-02
1.5500E 02	9.8592E-01		6.3957E-01	8.7202E-02
1.6000E 02	9.9586E-01		6.6620E-01	8.4354E-02
1.6500E 02	1.0035E 00		6.8680E-01	8.2164E-02
1.7000E 02	1.0095E 00		7.0735E-01	8.0472E-02
1.7500E 02	1.0141E 00		7.2231E-01	7.9156E-02
1.8000E 02	1.0177E 00		7.3427E-01	7.8132E-02
1.8500E 02	1.0206E 00		7.4380E-01	7.7327E-02
1.9000E 02	1.0229E 00		7.5140E-01	7.6693E-02
1.9500E 02	1.0247E 00		7.5747E-01	7.6189E-02
2.0000E 02	1.0261E 00		7.6235E-01	7.5767E-02
2.0500E 02	1.0273E 00		7.6623E-01	7.5465E-02
2.1000E 02	1.0283E 00		7.6939E-01	7.5205E-02

FIGURE 23b (2) INSULIN LOAD TEST (778 ng/min)

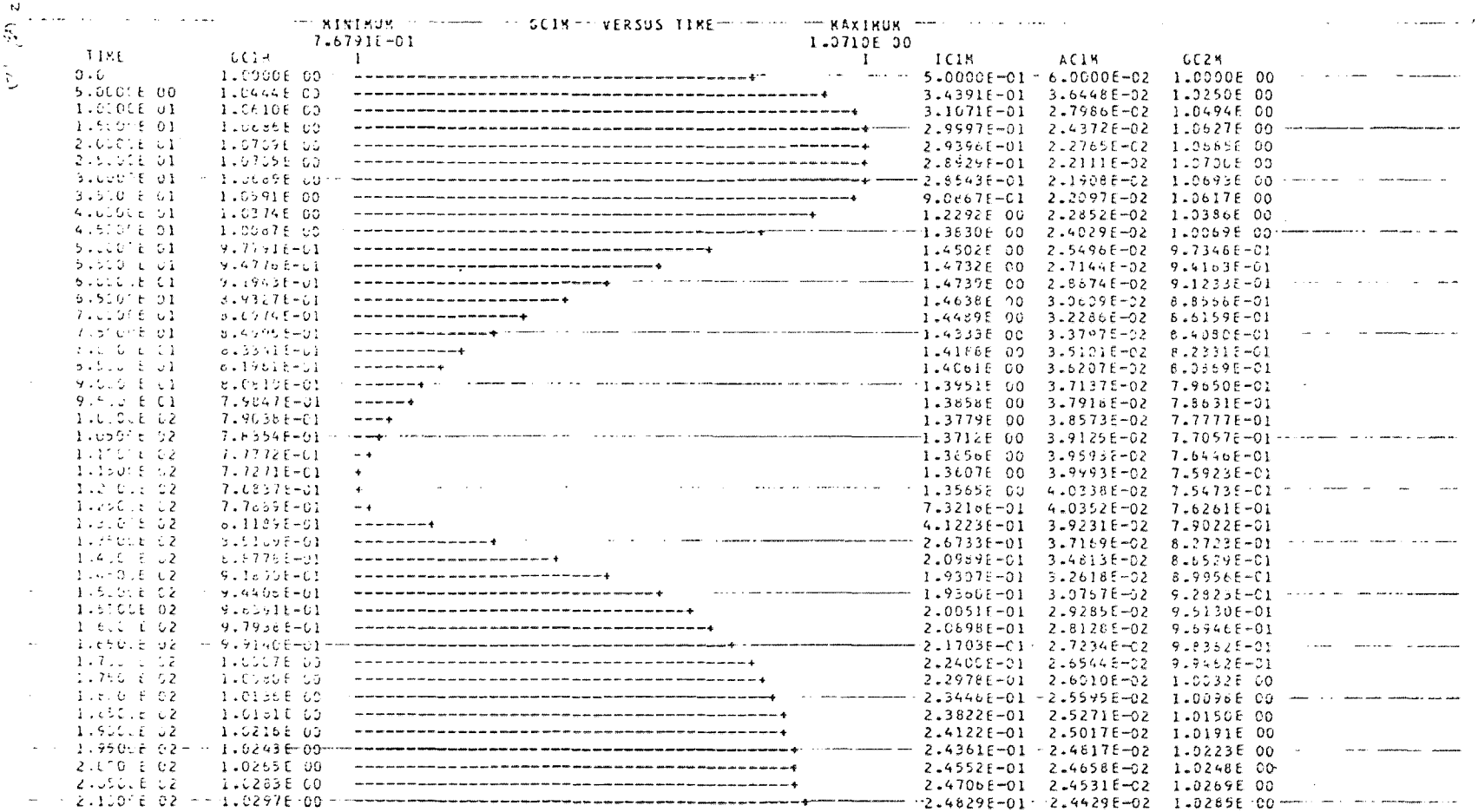


FIGURE 23c (1) INSULIN LOAD TEST (778 ng/min)

MINIMUM GRDELT VERSUS TIME MAXIMUM

-2.4431E 01 4.0794E 01

TIME	GRDELT	I	GRIN	GROUT	GCIR
0.0	4.0794E 01		6.5981E 01	2.5187E 01	1.0000E 00
5.0001E 00	3.6765E 00		3.4947E 01	2.6249E 01	1.0828E 00
1.0001E 01	5.5569E-01		2.6665E 01	2.6130E 01	1.0830E 00
1.5001E 01	-2.4185E 00		2.3610E 01	2.6020E 01	1.0795E 00
2.0001E 01	-3.4317E 00		2.2481E 01	2.5913E 01	1.0748E 00
2.5001E 01	-3.3232E 00		2.2530E 01	2.5820E 01	1.0739E 00
3.0001E 01	-2.9654E 00		2.2777E 01	2.5743E 01	1.0676E 00
3.5001E 01	-1.6073E 01		1.7726E 01	3.3799E 01	1.0490E 00
4.0001E 01	-2.1613E 01		1.6944E 01	3.8557E 01	1.0260E 00
4.5001E 01	-2.4031E 01		1.6989E 01	4.1020E 01	1.0005E 00
5.0001E 01	-2.4300E 01		1.7296E 01	4.1076E 01	9.7353E-01
5.5001E 01	-2.3507E 01		1.7730E 01	4.1316E 01	9.4654E-01
6.0001E 01	-2.2246E 01		1.8238E 01	4.0486E 01	9.2046E-01
6.5001E 01	-2.0695E 01		1.8791E 01	3.9486E 01	8.9587E-01
7.0001E 01	-1.7956E 01		2.0534E 01	3.8492E 01	8.7451E-01
7.5001E 01	-1.5022E 01		2.2605E 01	3.7630E 01	8.5757E-01
8.0001E 01	-1.2522E 01		2.4375E 01	3.6907E 01	8.4357E-01
8.5001E 01	-1.0453E 01		2.5857E 01	3.6311E 01	8.3195E-01
9.0001E 01	-8.7830E 00		2.7085E 01	3.5823E 01	8.2225E-01
9.5001E 01	-7.3332E 00		2.8091E 01	3.5424E 01	8.1412E-01
1.0001E 02	-6.1186E 00		2.8909E 01	3.5098E 01	8.0724E-01
1.0501E 02	-5.2594E 00		2.9570E 01	3.4829E 01	8.0137E-01
1.1001E 02	-4.5075E 00		3.0100E 01	3.4606E 01	7.9632E-01
1.1501E 02	-3.8790E 00		3.0524E 01	3.4423E 01	7.9193E-01
1.2001E 02	-3.4076E 00		3.0860E 01	3.4288E 01	7.8806E-01
1.2501E 02	2.0729E 01		4.6955E 01	2.6226E 01	8.1349E-01
1.3001E 02	3.2569E 01		5.6774E 01	2.4214E 01	6.5956E-01
1.3501E 02	-3.3068E 01		5.6930E 01	2.3041E 01	9.0236E-01
1.4001E 02	2.8606E 01		5.2450E 01	2.3684E 01	9.3512E-01
1.4501E 02	2.2997E 01		4.7046E 01	2.4044E 01	9.5913E-01
1.5001E 02	1.7966E 01		4.2214E 01	2.4246E 01	9.7673E-01
1.5501E 02	1.3760E 01		3.8323E 01	2.4437E 01	9.8982E-01
1.6001E 02	1.0710E 01		3.5317E 01	2.4607E 01	9.9971E-01
1.6501E 02	-8.2784E 00		3.3029E 01	2.4751E 01	1.0073E 00
1.7001E 02	6.4233E 00		3.1293E 01	2.4870E 01	1.0132E 00
1.7501E 02	5.0663E 00		2.9973E 01	2.4967E 01	1.0176E 00
1.8001E 02	3.9193E 00		2.8964E 01	2.5044E 01	1.0214E 00
1.8501E 02	3.0826E 00		2.8189E 01	2.5106E 01	1.0243E 00
1.9001E 02	2.4364E 00		2.7592E 01	2.5156E 01	1.0265E 00
1.9501E 02	1.9346E 00		2.7130E 01	2.5195E 01	1.0284E 00
2.0001E 02	1.5443E 00		2.6771E 01	2.5227E 01	1.0298E 00
2.0501E 02	1.2397E 00		2.6491E 01	2.5251E 01	1.0310E 00
2.1001E 02	1.0016E 00		2.6273E 01	2.5271E 01	1.0320E 00

FIGURE 23c (2) INSULIN LOAD TEST (778 ng/min)

Table III

Non-Conforming Mneumonic Terms

TERM	DESCRIPTION
A, B, C	Step functions used to generate INJECT timing waveshape
AAN	Normalized amino acid concentration in the liver
AR	Rate of glucagon secretion from pancreas (ng/min)
BRIVC	Blood flow in inferior vena cava (ml/min)
E	Base of natural logarithm
EWM	Quantity of glycogen that has been produced from glucose in the muscle
FACTOR	Factor of the variable (GR22L1) which is limited by the function (GLGL)
GLGL	Limit function of the term (FACTOR)
GLOAD	Glucose load (mg/min)
GLUGLY	Limit function of the factored term (GLYSTO) for the variable (SEW3L)
GLYSTO	Factor of variable (SEW3L) which is limited to produce (GLUGLY)
GRDELT	Net rate at which the glucose in the blood is changing (mg/min)
GRIN	Total rate at which glucose is being put into the blood (mg/min)
GROUT	Total rate at which glucose is being removed from the blood system (mg/min)

Table III (Continued)

Non-Conforming Mneumonic Terms

TERM	DESCRIPTION
GR1C	Rate at which blood is transporting glucose into the blood plasma volume (V1C) of the head.
GR22L1	Rate at which glycogen is converted to glucose by the liver (mg/min)
GR22L2	Rate at which glucose is produced from amino acids by the liver (mg/min)
GR22L3	Rate of glucose production from lactate in the liver (mg/min)
GR22L4	Rate of glucose production from glycerol in the liver (mg/min)
GW22L1	Quantity of glucose produced from glycogen by the liver (mg)
HEPART	Blood flow in hepatic artery
HK	Plasma ratio, ratio of blood plasma to whole blood, $= \frac{100 - \text{Hematocrit}}{100}$
ILOAD	Insulin load (ng/min)
INJECT	Timing waveshape used to control injection of either glucose or insulin into model
IR	Rate of insulin secretion from pancreas (ng/min)
LAR	Limit function for (AR) term
LIR	Limit function for (IR) term

REFERENCES

1. Bartosek, I. (ed.), Guaitani, A. (ed.) and Miller, L. L. (ed.), Isolated Liver Perfusion and Its Applications. Rave Press, 1973.

2. Benson, S. A., Yalow, R. S., and Volk, B. W., J. Lab. Clin. Med., Volume 49, p. 331, 1957.

3. Bishop, J., Goldberg, N. D., and Larner, J., "Insulin Regulation of Hepatic Glycogen Metabolism in the Dog." Am. J. Physiol., Volume 220 (2), pp. 499-506, 1971.

4. Bishop, J. S., Steele, R., Altszuler, N., Dunn, A., Bjerknes, C., and de Bodo, R. C., "Effects of Insulin on Liver Glycogen Synthesis and Breakdown in the Dog." Am. J. Physiol., Volume 208 (2), pp. 307-316, 1965.

5. Brachet, J., "The Living Cell." Scientific America, Volume 205, Number 3, September 1961.

6. Buschiazzo, H., Exton, J. H., Park, C. R., "Effects of Glucose on Glycogen Synthetase, Phosphorylase, and Glycogen Deposition in the Perfused Rat Liver." Proceedings of the National Academy of Sciences, Volume 65, Number 2, pp 383-387, 1970.

7. Cahill, G. F., et al, "Hormone-Fuel Interrelationship During Fasting." Journal of Clinical Investigation, Volume 45, Number 11, 1966.

8. Cahill, G. F. Jr., "Starvation in Man." New England Journal of Medicine, Volume 282, Number 12, pp 668-675, 1970

9. Capaldi, R. A., "Dynamic Model of Cell Membranes." Scientific America, Volume 230, Number 3, March, 1974.

10. Chiasson, J. L., Cook, J., Liljenquist, J. E., and Lacy, W. W., "Glucagon Stimulation of Gluconeogenesis From Alanine in the Intact Dog." American Journal of Physiology, Volume 227, Number 1, 1974.

11. Chiasson, J. L., Liljenquist, J. E., Sinclair-Smith, B. C., and Lacy, W. W., "Gluconeogenesis From Alanine in Normal Postabsorptive Man." Diabetes, Volume 24, Number 6, 1975.

12. Christy, N. P., (ed.), The Human Adrenal Cortex. Harper & Row, 1971.

13. Clegg, P. C., and Clegg, A. G., Hormones, Cells and Organisms. Stanford University Press, p 33, 1969.

14. Clegg, P. C., and Clegg, A. G., Hormones, Cells and Organisms. Stanford University Press, p 73-74, 1969.

15. Clegg, P. C., and Clegg, A. G., Hormones, Cells and Organisms. Stanford University Press, p 74, 1969.

16. de Bodo, R. C., Steele, R., Altszuler, N., Dunn, A., Bishop, J. S., "Effects of Insulin on Hepatic Glucose Metabolism and Glucose Utilization by Tissues." Diabetes, Volume 12, Number 1, January-February, 1963.

17. de Bodo, R. C., Steele, R., Altszuler, N., Dunn, A., Bishop, J. S., "Effects of Insulin on Hepatic Glucose Metabolism and Glucose Utilization by Tissues." Diabetes, Volume 12, Numer 25, p. 25, January-February, 1963.

18. De Wulf, H., and Hers, H.G., "The Role of Glucose, Glucagon and Glucocorticoids in the Regulation of Liver Glycogen Synthesis." European Journal Bio-chemistry, Volume 6, Number 4, pp 558-564, 1968.

19. Exton, J.H., "Gluconeogenesis." Metabolism, Volume 21, Number 10, (October), p 961, 1972.

20. Exton, J. H., "Gluconeogenesis." Metabolism, Volume 21, Number 10, (October), 1972.

21. Exton, J. H., Park, C. R., "Control of Gluconeogenesis in Liver, Part I." Journal of Biological Chemistry, Volume 242, Number 11, pp 2622-2636, 1967.

22. Exton, J. H., and Park, C. R., "Control of Gluconeogenesis in Liver, Part II." Journal of Biological Chemistry, Volume 243, Number 16, Issue of August 25, pp. 4189-4196, 1968.

23. Ezdinli, E. Z., and Sokal, J. E., "Comparison of Glucagon and Epinephrine Effects in the Dog." Endocrinology, Volume 78, pp. 47-54, 1966.

24. Ezdinli, E. Z., and Sokal, J. E., "Comparison of Glucagon and Epinephrine Effects in the Dog." Endocrinology, Volume 78, p. 48, 1966.

25. Ezdinli, E. Z., and Sokal, J. E., "Comparison of Glucagon and Epinephrine Effects in the Dog." Endocrinology, Volume 78, p. 50, 1966.

26. Ezdinli, E. Z., and Sokal, J. E., "Comparison of Glucagon and Epinephrine Effects in the Dog." Endocrinology, Volume 78, p. 51, 1966.

27. Finkelstein, S. M., Bleicher, M. A., Batthany, S., and Tiefenbrum, J., "In Vivo Modeling for Glucose Homeostasis." IEEE Transactions on Biomedical Eng., Volume BME-22, Number 1, January, 1975.

28. Ganong, W. F., Review of Medical Physiology. Lange Medical Publications, 6th Edition, p. 5, 1973.

29. Ganong, W. F., Review of Medical Physiology. Lange Medical Publications, 6th Edition, p. 251, 1973.

30. Ganong, W. F., Review of Medical Physiology. Lange Medical Publications, 6th Edition, p. 257, 1973.

31. Ganong, W. F., Review of Medical Physiology. Lange Medical Publications, 6th Edition, p. 451, 1973.

32. Gerich, J. E., Charles, M. A., and Grodsky, G. M., "Characterization of the Effects of Arginine and Glucose on Glucagon and Insulin Release From the Perfused Rat Pancreas." Journal of Clinical Investigation, Volume 54, pp. 833-841, 1974.

33. Guillemin, R., Burgus, R., "The Hormones of the Hypothalamus." Scientific America, Volume 226, Number 5, November 1972.

34. Hamilton, W. F., (Sec. Ed.), Dow P., (Exec. Ed), Handbook of Physiology, Section 2, Circulation, Volume II. American Physiological Society, 1963.

35. Holter, H., "How Things Get Into Cells." Scientific America, Volume 205, Number 3, September, 1961.

36. Iversen, J., "Secretion of Glucagon From the Isolated, Perfused Canine Pancreas." Journal of Clinical Investigation, Volume 50, pp. 2123-2136, 1971.

37. Jenkins, J. S., Biochemical Aspects of the Adrenal Cortex. Edward Arnold, London, 1968.

38. Kaplan, S. A. and Nagareda Shimizu, C. S., "Effects of Cortisol on Amino Acids in Skeletal Muscle and Plasma." Endocrinology, Volume 72, pp. 267-272, 1963.

39. Katz, B., "How Cells Communicate." Scientific America, Volume 205, Number 3, September, 1961.

40. Lerner, R. L., Porte, D. Jr., "Relationship Between Intravenous Glucose Loads, Insulin Responses and Glucose Disappearance Rate." J. Clin. Endocr., Volume 33, pp. 409-417, 1971.

41. Li, C. H., "The ACTH Molecule." Scientific America, Volume 209, Number 1, July, 1969.

42. Maddaiah, V. T. and Madsen, N. B., "Studies on the Biological Control of Glycogen Metabolism in Liver." Biochimica et Biophysica ACTA, 121, pp. 261-268, 1966.

43. Mallette, L. E., Exton, J. H., and Park, C. R., "Control of Gluconeogenesis From Amino Acids in the Perfused Rat Liver." Journal of Biological Chemistry, Volue 244, pp. 5713-5723, October, 1969.

44. Mallette, L. E., Exton, J. H., and Park, C. R., Effects of Glucagon on Amino Acid Transport and Utilization in the Perfused Rat Liver." Journal of Biological Chemistry, Volume 244, Number 20, pp. 5724-5728, 1969.

45. Matschinsky, F. M., Pagliara, A. S., Hover, B. A., Haymond, M. W., Stillings, S. N., "Differential Effects of Alpha and Beta - D - Glucose on Insulin and Glucagon Secretion From the Isolated Perfused Rat Pancreas." Diabetes, Volume 24, pp. 369-372, 1975.

46. Matsui, N., Plager, J. E., "Rate of Blood Glucose Fall as a Determinant Factor in Insulin-Induced Adrenocortical Stimulation." Endocrinology, Volume 79, p. 737, 1966.

47. Mirsky, A. E., Allfrey, V. G., "How Cells Make Molecules." Scientific America, Volume 205, Number 3, September, 1961.

48. Morgan, H. E., Neely, J. R., Wood, R. E., Liebecq, C., Liebermeister, H., and C. R. Park. "Factors Affecting Glucose Transport in Heart Muscle and Erythrocytes." Federation Proceedings, Volume 24, pp. 1040-1045, 1965.

49. Mortimore, G. E., "Effects of Insulin on Release of Glucose and Urea by Isolated Rat Liver." Am. J. Physiol., Volume 204 (4), pp. 699-704, 1963.

50. Munro, H. N., Allison, J. B., Mammalian Protein Metabolism. Academic Press, 1964.

51. Norfleet, W. T., Pagliara, A. A., Haymond, M. W., and Matschinsky, F., "Comparison of Alpha-and Beta-Cell Secretory Responses in Islets Isolated with Collagenase and in the Isolated Perfused Pancreas of Rats." Diabetes, Volume 24, pp. 961-970, 1975.

52. Pagliara, A. S., Stillings, S. N., Hover, B., Martin, D. M., and Matschinsky, F., "Glucose Modulation of Amino Acid-Induced Glucagon and Insulin Release in the Isolated Perfused Rat Pancreas." Journal of Clinical Investigation, Volume 54, pp. 819-832, 1974.

53. Palmer, J. P., Walter, R. M., and Ensinck, J. W., "Arginine-stimulated Acute Phase of Insulin and Glucagon Secretion." Diabetes, Volume 24, Number 8, 1975.

54. Parrilla, R., Goodman, M. N., Toews, C. J., "Effects of Glucagon: Insulin Ratios on Hepatic Metabolism." Diabetes, Volume 23, pp. 735-731, 1974.

55. Perkoff, G. T., Parker, V., McCall, J. C., Tyler, F. H., "Early Effects of Cortisol on Glucose Metabolism in Man." Journal of Lab. and Clin. Med., Volume 62, Number 3, 1963.

56. Pozefsky, T., Felig, P., Soeldner, J. S., Cahill, G. F. Jr., "Insulin Blockade of Amino Acid Release by Human Forearm Tissues." Ass. Amer. Physicians, Philadelphia, pp. 258-265, 1969-1970.

57. Rushmer, R. F., Cardiovascular System. Saunders, Philadelphia, 1972.

58. Sanders, R. B., and Riggs, T. R., "Modification by Insulin of the Distribution of Two Model Amino Acids in the Rat." Endocrinology, 80:29, 1967.

59. Scharff, R., and Woll, I. G., "Accumulation of Amino Acids in Muscle of Perfused Rat Heart." Journal of Biochemistry, Volume 97, pp. 272-276, 1965.

60. Scriver, C. R., Rosenberg, L. E., Amino Acid Metabolism and Its Disorders. W. B. Saunders Company, Philadelphia, 1973.

61. Smith, G. A., Llaurado, J. G., "Computer Modeling of Nonsteady State Sodium Kinetics in Liver." IEEE Transactions on Biomedical Engineering, Volume BME-21, Number 6, November, 1974.

62. Smith, O. K., and Long, C. N. H., "Effects of Cortisol on the Plasma Amino Nitrogen of Eviscerated." Endocrinology, Volume 80, pp. 561-566, 1967.

63. Sokal, J. E., "Effects of Glucagon on Gluconeogenesis by the Isolated Perfused Rat Liver." Endocrinology, Volume 78, pp. 538-548, 1966.

64. Sokal, J. E., and Ezdinli, E. Z., J. Clin. Invest., Volume 46, p. 778, 1967.

65. Sokal, J. E. Sarcione, E. J., Henderson, A. M., "Relative Potency of Glucagon and Epinephrine as Hepatic Glycogenolytic Agents: Studies with the Isolated Perfused Rat Liver." Endocrinology, Volume 74, pp. 930-939, 1964.

66. Solomon, A. K., "Pores in the Cell Membrane." Scientific America, Volume 203, Number 6, December, 1960.

67. Wainwright, T. E., Adler, B. J., "Molecular Motion." Scientific America, Volume 201, Number 4, October, 1959.

68. Williamson, J. R., "Effects of Fatty Acids, Glucagon and Anti-Insulin Serum on the Control of Gluconeogenesis." Advance. Enzyme Regulations, Volume 5, pp. 229-255, 1967.

69. Wise, J. K., Hendler, R., Felig, P., "Influence of Glucocorticoids on Glucagon Secretion and Plasma Amino Acid Concentrations in Man." Journal of Clinical Investigation, Volume 52, pp. 2779-2782, 1973.

70. Zuckerman, S., "Hormones." Scientific America, Volume 196, Number 3, March, 1957.