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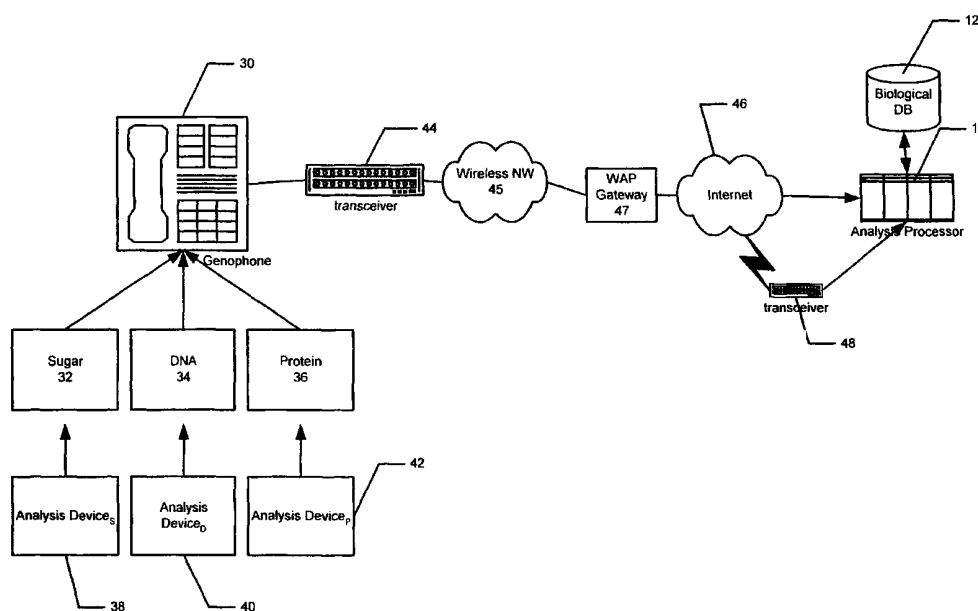
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[Continued on next page]

(54) Title: **SYSTEM AND METHOD FOR GENOMIC AND PROTEOMIC AGRICULTURAL DISEASE ASSESSMENT VIA EXPRESSION PROFILE COMPARISON**



(57) Abstract: A system and method of genomic and proteomic disease assessment via expression profile comparison whereby a baseline expression profile is created by a user by depositing a biological sample on an analysis device. The biological information is read on an analysis device reader and transmitted to an analysis center where it is stored. The user deposits subsequent biological samples, which are compared to the stored sample that is originally taken. The analysis center compares the initial expression profile with subsequent expressions profiles to determine the health of the source of the sample. The biological sample can be from plants. The analysis device reader can be a wired or wireless device connected to a personal computer which in turn is connected to the Internet. In an alternate embodiment, the analysis device reader is in a cellular type telephone for wireless transmission. In yet another embodiment, the analysis device reader is in a kiosk which dispenses analysis devices and where it can be used by anyone with a credit token. Interpreted information is then returned to the appropriate person with advice on the meaning of the interpreted results, other sources of expert assistance and counseling where necessary.



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**Title of Invention:** System and Method for Genomic and Proteomic Agricultural Disease Assessment via Expression Profile Comparison

## Field of the invention

This invention relates generally to genomic or proteomic testing. More particularly this invention provides a system and method for measuring the expression of the genome and other biological factors over a network, which could lead to disease prediction and prevention in plants.

## Background Of The Invention

Mapping of the human genome has been in process by both the government and private industry for the past ten years. At the same time new research has lead to specific tests for conditions that are evidenced by genes and certain gene expressions. Further the methods for the detecting of genomic, proteomic and other biological factors have dramatically improved.

Similarly, genetic engineering and research is extremely active in the agricultural marketplace where both plants and animals are the subject of genetic engineering and commercialization.

Research is rapidly progressing on DNA chips from, for example, Affymetrix, and RNA and protein chips available from, for example, CIPHERgen, which will allow genes, their expression and proteins to be identified on a particular chip. Further Micro Arrays such as those of Nycomed Amersham / Amersham Pharmacia Biotech allow gene detection via very small detectors, thereby reducing the size of the overall detector package. Further, advances in fiber optic probes for example by Illumina, Inc. now allow 250,000 discrete sensors to fit on a probe the diameter of a pin head for proteomic studies. For purposes of this application, such chips, arrays and probes are referred generally as "Analysis Devices." Other similar technologies are available from PE Biosystems, Nycomed Amersham, Nanogen, Hyseq, Caliper, Clinical Micro Sensors. Specifically, Nanogen possesses electronic concentration and hybridization technology that is suited to the present invention. Such technology

1 is embodied in a disposable cartridge comprising a semiconductor microchip and  
2 electrical and fluidic connections for use in analysis equipment. The following U.S.  
3 patents discuss this technology, the contents of the below listed patents are  
4 incorporated herein by reference in their entirety:

5 U.S. Patent No. 6,099,803 "Advanced active electronic devices for molecular  
6 biological analysis and diagnostics "

7 U.S. Patent No. 6,071,394 "Channel-less separation of bioparticles on a  
8 bioelectronic chip by dielectrophoresis "

9 U.S. Patent No. 6,068,818 "Multicomponent devices for molecular biological analysis  
10 and diagnostics"

11 U.S. Patent No. 6,051,380 "Methods and Procedures for Molecular Biological  
12 Analysis and Diagnostics"

13 U.S. Patent No. 6,048,690 "Methods for Electronic Fluorescent Perturbation for  
14 Analysis and Electronic Perturbation Catalysis for Synthesis "

15 U.S. Patent No. 5,849,486 "Methods For Hybridization Analysis Utilizing  
16 Electronically Controlled Hybridization"

17 U.S. Patent No. 5,605,662 "Active Programmable Electronic Devices for Molecular  
18 Biological Analysis and Diagnostics"

19 Other analysis techniques also exist and are suitable for use with the present  
20 inventions. For example, patent no. 6,045,676 was issued to Mathies et al. for a  
21 "Electrochemical detector integrated on microfabricated capillary electrophoresis  
22 chips" for use in detecting molecules. The contents of this patent are incorporated  
23 herein by reference in its entirety.

24 The LabCD manufactured by Gamera Bioscience Corp. also represents  
25 technology that is suitable to sample preparation that would find use in the present  
26 invention. The capabilities and format of the LabCD are described in U.S. Patent No.  
27 6,063,589 which is incorporated herein by reference in its entirety.

28 These analysis devices can then be used to determine if the particular gene  
29 in question is working properly with other genes, or if other biological factors are

1 present which may be indicative of certain physiological conditions.

2       These devices can also be used to map vegetative genome and to develop  
3 understanding regarding how they are expressed in a plant's physiology or in its  
4 fluids (for example, but not limited to secretion, metabolites, juices and other fluids).  
5 For example it would be very useful for certain individuals such as, farmers (small or  
6 large), nurseries, but not limited to (agricultural professionals), to obtain a plant's  
7 expression profile of the plant's genes so that it can be used for assessing the plant's  
8 normal versus abnormal condition states. If, for example, a farmer knows the  
9 difference between the normal expression of genes and the deviations from normal  
10 which are statistically important, that could prevent for example, poor harvests, late  
11 harvests and other conditions that are reflected by a mutated gene, which mutation  
12 may also be good for the plant's growth. It would also be useful to have the plant's  
13 expression profile, which would be a baseline or standard, for subsequent  
14 comparison of normal versus abnormal conditions.

15       This expression profile would be useful to determine if a particular crop is  
16 suffering a type of stress that is related to disease or to growing conditions before  
17 those conditions manifest themselves in a loss of the crop.

## 18 **Summary Of The Invention**

19       It is therefore an objective of the present invention to produce a specific tool in  
20 the form of a genophone, a computer with associated reader, and a standalone  
21 station, which will read an analysis device which will, in turn, measure the expression  
22 of genes and other biological parameters in the secretion, metabolites, juices and  
23 fluids of plants.

24       It is another objective of the present invention to establish a baseline of the  
25 gene expression, and expression of other biological factors such as, but without  
26 limitation, small molecules, peptides and metabolites for healthy plants of many  
27 species so that plant health can be monitored during the various cycles.

28       It is yet another objective of the present invention to create a standard  
29 expression map for the plant species that are to be monitored using an analysis

1 device so that expression of every gene and other biological factors can be identified  
2 and compared with previous samples from the same monitored plant.

3 It is a further objective of the present invention to characterize gene  
4 expression or other biological indicators at a disease stage for comparison to a  
5 "standard" expression profile for plants.

6 It is yet another objective of the present invention to characterize the  
7 expression of individual gene expression profiles periodically during the life-cycles of  
8 plants of interest, and to store that data on a dedicated site for subsequent review  
9 and comparison.

10 It is a further objective of the present invention to have an individual analysis  
11 device read at a convenient site, at a site other than a laboratory, in public places,  
12 and in hand held devices and have that information transmitted to a central analysis  
13 site over a network which could be the Internet, an intranet, a wireless network or  
14 some other network able to transmit data.

15 It is still another objective of the present invention to collect expression profile  
16 information together with species history information to produce a database relating  
17 to expression patterns and variation to phenotype state and prognosis.

18 It is a further objective of the present invention to have an Internet analysis  
19 site and database of plant metabolism maps, clinical data and other biological  
20 indicators and conditions with conclusions and interpretations associated with the  
21 differential expression of certain genes and other biological parameters.

22 It is yet another objective of the present invention to allow agricultural  
23 professionals to collect and digitize (or render in some other transmittable form)  
24 sample expressions profiles (or other biological information) at the farm, or via some  
25 hand held device to provide that digitized individual expression profile (or other  
26 biological information) over a network to a central analysis site, and to have that  
27 analysis site provide an interpretation of the plant's expression profile with  
28 conclusions regarding the plant's condition.

29 It is yet another objective of the present invention to provide an analysis

1 tool comprising a browser and analyzer that will allow the data to be transmitted to  
2 the analysis site, analyzed according to the plant's standard expression data stored  
3 in a specific biological database, and to have a response generated to be sent to the  
4 agricultural specialist in a electronic, magnetic, written or audio form so that such  
5 persons can get results of the analysis right away on the comparison and differences  
6 from the standard expression profile. These and other objectives for the present  
7 invention will become apparent from a detailed review of the specification that  
8 follows.

9 The present invention comprises a plurality of analysis devices and other  
10 detection means that can be produced and distributed to individuals and  
11 professionals in the agricultural sciences in great quantities. It is the intention of the  
12 present invention to produce such analysis devices in sufficient quantities so that  
13 they can be made available to all who desire them in a cost effective fashion. Over  
14 time it is expected that the cost of such analysis devices will decrease dramatically  
15 and therefore allow analysis devices to be available to anyone desiring to  
16 characterize the expression of the genome of a particular plant or crop or other  
17 biologically related information.

18 These analysis devices are used by an agricultural professional for  
19 determining a plant's control or "standard" expression profile of the plant's genes or  
20 other biological indicators that are to be monitored. A sample of secretion,  
21 metabolite, or other sample from a plant is obtained and placed in / on the analysis  
22 device. The analysis chip, for example, contains probes for all plant genes linked to  
23 the surface of the chip. Such chips are capable of detecting the presence of other  
24 nucleic acids (specifically messenger RNA), which are present in the solution via  
25 homology hybridization. Analysis Chips may contain small fragments of the genes  
26 (oligonucleotides) or expressed sequence tags (ESTs) or RNA molecules or their  
27 fragments as well as proteins or their fragments. Other detector devices will have  
28 similar mechanisms for detecting the biological indicator of interest. Other types of  
29 devices include, and without limitation, a "lab-on-a-chip" with microchannel

1 separation of biological materials (DNA, RNA, protein, hormone, small molecule,  
2 peptide, metabolite) with subsequent electrochemical or electric, such as those of  
3 Clinical Micro Sensors or optical, such as those of PharmaSeq detection. Such  
4 technology also includes 3D silicon particles of cubic or spheric shape, which could  
5 carry detection molecules (DNA, RNA, antibodies). The amplification via polymerase  
6 chain reaction (PCR) or other methods may be required for enhancing the strength of  
7 the signal in biological sample.

8 These above methods are not meant as a limitation. For example,  
9 immunoassays, small molecule sensors for metabolites, peptides, hormones and  
10 other measures are also within the scope of the present invention. The emphasis in  
11 all cases however, is to measure these response variables and record the status at a  
12 variety of times in the lifespan or growing season of the plant or crop so that  
13 predictions of future health can be made.

14 The expression or recording of these biological indicators can then be  
15 digitized or put in some other transmittable form at the farm or at a convenient  
16 location, on the analysis device reader or other device to make the genetic  
17 expression or recording of biological indicators of the plant in the form that is  
18 transmittable via the network. Based on the reading, a digitized record of the  
19 expression profile of the genome of the plant, which includes transcriptome (all  
20 molecules of RNA expressed in the cell as well as in the body), proteome (i.e. the  
21 proteome is the summary of all proteins) or other biological indicator is then created.

22 As part of the present invention, the hand held device or computer attached device  
23 or real time monitoring station will detect genetic variations of the plants including,  
24 but not limited to, Single Nucleotide Polymorphisms (SNPs) as well as genetic  
25 variations in genes of another nature. Those can be compared for a particular plant  
26 over time – giving a chance to build a time-correlation of the progression of the  
27 disease. Clinical data will be used to compare populational data of norm versus  
28 disease. SNPs could be detected in devices developed by Hyseq or Sequenom, or  
29 other manufacturers.



1 Genetic variation noted above can be accomplished on a general basis where  
2 many genes are detected and analyzed or, when suggested via background or  
3 species history, on a specific SNP analysis based upon expression work done  
4 previously. This could be done at the farm or at an analysis station or at a regional  
5 laboratory.

6 The present invention comprises an analysis and database site that exists on  
7 a network, preferably but without limitation on the Internet, that has extensive  
8 information on plant genomes of interest and the meaning of various genetic  
9 expressions and mutations as well as metabolism maps. An agricultural professional  
10 wishing to have an expression profile or a specific crop reviewed, read, and  
11 interpreted will send a digitized record created at the analysis device reader over the  
12 Internet, or via some other wired or wireless network to the analysis site. The  
13 software routines for analysis and interpretation at the analysis site will then read the  
14 digitized or transmittable record and interpret that record providing feedback to the  
15 agricultural professional over the Internet, over an intranet, a wireless network or via  
16 any other means (such as voice) for conveniently reporting such information to the  
17 agricultural professional. A standard PC could also be used for storage and  
18 interpretation as well as warning the agricultural professional.

19 Such an invention can also be used to simply provide an expression profile for  
20 a plant when that plant is healthy. This "standard" or "baseline" gene expression  
21 profile is then stored at the analysis site for later use. This will be important since  
22 expression of genes varies with disease and also varies over the plant's life-cycles.  
23 Further when a plant is not healthy, that agricultural professional can create a new  
24 gene expression profile, read and digitize the Analysis device results, provide the  
25 results to the analysis site over the Internet, or to a standard PC, compare the  
26 digitized results to that plant's baseline or standard gene expression profile, and  
27 make some determination on what has changed and what the impact of that change  
28 actually is. Agricultural professionals will want to establish baseline profiles for crops  
29 to be monitored. Once information is developed based on the gene expression

1 profiles, analysis results can be reported to the field where corrective action can take  
2 place. Analysis of results prior to reporting is accomplished by organizations having  
3 databases specific to the species involved. For example, a database for agricultural  
4 products could be maintained by the USDA.

5 The control gene expression profile or other biological characteristics will also  
6 have other uses. From time to time, over a period of years, an agricultural  
7 professional can provide a new series of digitized or otherwise recorded biological  
8 indicators to the analysis site central database and determine how the plant species  
9 expression profile is changing. This may suggest certain interventions on the part of  
10 the agricultural professional.

11 The present invention provides for a flexible series of methods and associated  
12 apparatus allowing agricultural professionals to create a record of the plant's gene  
13 expression (RNA and protein) to broaden profiles and other genomic and biological  
14 information in a convenient fashion. For example, one embodiment of the present  
15 invention provides for an analysis device reader to be attached or connected to a PC  
16 for subsequent reading and providing information over a network, which is preferably,  
17 but without limitation, the Internet. In another embodiment, analysis device readers  
18 may be located with agricultural professionals to provide such information for  
19 subsequent analysis when a personal computer and analysis chip reader is not  
20 available.

21 Yet another alternate embodiment allows for a single purpose analysis device  
22 reader which can provide genetic information over a network. Such a device may be  
23 a single purpose device optimized to look for a specific gene, metabolite or other  
24 indicator of a condition. Yet another alternate embodiment allows for the wireless  
25 presentation of analysis device information over a radio network, for example over a  
26 cellular network. In this alternate embodiment a form of wireless or cellular type  
27 device, hereinafter referred to as a genophone, allows genetic or other biological  
28 information to be provided over wireless and/or cellular type networks to an analysis  
29 center.

1 Yet another alternate embodiment of the present information allows for a  
2 kiosk type operation whereby an analysis device dispenser is located in a centralized  
3 location for the input of plant information such as at a regional agricultural extension  
4 center. In use, an individual would simply use a credit card or, preferably a smart  
5 card having specific encrypted identification information, that is linked to a credit card  
6 processing company such as American Express®, VISA®, MasterCard®, or other  
7 for billing services. The agricultural professional simply inserts the credit/smart card  
8 and, after credit verification, would receive an analysis device upon which a  
9 biological sample from a plant could be deposited. The analysis device would then  
10 be read by the kiosk analysis device reader and information from the reading sent to  
11 the analysis site. Thereafter, the agricultural professional can enter information either  
12 at the kiosk location or, using coded information that is present on the smart card,  
13 the agricultural professional can cause the results of the analysis to be sent back to  
14 the agricultural professional via the US Mail, via electronic mail, or via any other  
15 selected delivery service which the user prefers including voice transmission to a  
16 selected telephone number or voice mail. In any case, such information is sent to  
17 the person involved together with information on how to locate source to assist in  
18 proper interpretation of the data. In certain instances, scientific resources would also  
19 be identified depending upon the outcome or projected outcome to help the  
20 agricultural professional understand the results received.

21 The present invention also comprises a genome and health information-  
22 specific encrypted browser for individual use. This browser, when used with the  
23 personal computer or in use with video phones or the like, allows genomic and other  
24 biological information from the individual to be appropriately delivered directly to an  
25 analysis site as well allows rapid and encrypted access to specific species and gene  
26 analysis sites. In this fashion agricultural professionals will not need to expend  
27 significant effort in browsing the World Wide Web for information to support  
28 conclusions or preliminary analyses made concerning the plant's expression profile.

29 Using the encrypting browser, the agricultural professional can access a

1 database of genomic and other biological information of the present invention that  
2 comprises the plant's control expression profiles and management of the plant's  
3 history, all of which will be encrypted. However, in addition there will be a database  
4 of metabolic pathways which will be used to characterize the protein or other  
5 expression molecules and characterize and tell what role the protein that is detected  
6 has in the overall health picture of the plant. It is part of the present invention to  
7 develop a secure bank-type of mechanism, which will allow for the secured  
8 transaction of the genomic and proteomic information of various crops and plants.  
9 Such a facility could be established with a partner (i.e. American Express).

10 In the case of agricultural applications an agricultural genome sequence  
11 comparison database is also a part of the present invention and allows plant control  
12 expression profiles as well as subsequent expression profiles to be compared to  
13 various standard expression profiles for analysis purposes.

14 Further, the database will contain subsequent databases and/or links to  
15 clinical data, clinical trials in practice, "live" consulting with experts as well as chat  
16 rooms to discuss with others genomically, biologically, and medically important  
17 information relating to the type of plant concerned.

18 Any information that an agricultural professional wishes to store that is  
19 particular to the individual's concern (about the crop's past harvests or diseases) can  
20 be stored in the individual storage area of the database in an encrypted form so that  
21 only the individual who has placed that data in the database can have access to the  
22 data.

23 The genophone described above will have a series of capabilities. For  
24 example it will be able to read DNA or RNA using an appropriate DNA or RNA chip  
25 and transmit that information over the wireless network to the analysis center. These  
26 chips mentioned above are not meant as a limitation. Other analysis devices as  
27 noted earlier will provide for other clinical targets as well such as peptides, hormones  
28 and metabolites. Further, the genophone will have a separate protein analysis  
29 cartridge, including those which could have antibodies, enzymes or other protein

1 detection systems and separate sugars or other biological molecules specific to  
2 plants, analysis cartridge each of which will be capable of receiving the associated  
3 device for deposit of a sample and analysis of the proteins, sugars and other  
4 metabolites as appropriate. It is further anticipated that these cartridges could  
5 integrated in one single cartridge or unit. This "cartridge" can be a variety of forms  
6 and the form is not meant as a limitation. In other forms it employs the various  
7 detection technologies discussed (above). For example, the cartridge may be an  
8 attachment to the genophone, or it may be its separate instrument or device with its  
9 own communications capability for providing information over a network. Cartridge  
10 may have different sets of detection mechanisms specific for a particular gene of the  
11 gene product or group of genes and their products, which could lead to different  
12 types of diseases, (i.e., a cartridge for monitoring gene expression which could lead  
13 to diseased crops). Cartridges with different types of disease "preventive"  
14 expression and other monitoring could combine different types of diseases on one  
15 cartridge.

16 In addition, specific disease state monitoring can be accomplished by the  
17 equipment of the present invention. Thus monitoring plant physiology, genotype,  
18 primary metabolites produced can be achieved. Agricultural professionals can  
19 assess the efficacy of the treatment and the extent to which treatment should  
20 continue. The professional will also be able to assess whether the mutation is  
21 advantageous, that is, a change in the plant that should be encouraged rather than  
22 cured. Expression analysis of the type disclosed with the present  
23 invention is well within the current state of the art. For example, a GeneChip™ is an  
24 analysis probe array manufactured by Affymetrix® which can detect MRNA  
25 transcripts at a few copies per cell. It can also identify concentration levels and  
26 simultaneously monitor thousands of genes. This GeneChip™ system is typically  
27 scanned by an HP GeneArray scanner to view an expression analysis. Yet another  
28 potential technology for analysis is the Assembled Array™ manufactured by Illumina,  
29 Inc. This array provides thousands of sensors to analyze DNA, RNA, and protein.

1 Yet another example of chip analysis technology is the ProteinChip™ which is  
2 available from CIPHERGEN. Other analysis devices such as the GeneChip™  
3 instrument system, also available from Affymetrix which provides a platform for  
4 analyzing GeneChip probe arrays. In short, certain of the building blocks are readily  
5 available for the present invention.

#### 6 **Brief Description Of The Figures**

7 Figure 1 illustrates the overall architecture of the present invention

8 Figure 1A illustrates the stand-alone analysis device reader

9 Figure 2 illustrates the genophone embodiment of the present invention

10 Figure 3 illustrates the kiosk embodiment of the present invention

#### 11 **Detailed Description Of The Invention**

12 The present invention is a system and method for creation of expression  
13 profiles of plants, establishing a control expression profile for a plant, and comparing  
14 subsequent expression profiles to the control expression profile for analysis  
15 purposes. For purposes of this detailed description of the invention, the procedures  
16 when dealing with plant genomic information will be discussed. These samples are  
17 analyzed via chips in the same manner as that disclosed in plant analysis. Any  
18 reporting that is done will be in terms of the plant in question.

19 Referring to Figure 1, a control biological sample for the plant species in  
20 question will be provided on analysis devices **22, 24,** and **26**. The analysis devices  
21 will be input to analysis device readers **16**, which, in one instance are connected to  
22 PCs **14, 20** at user locations. It is also considered to be within the scope of the  
23 present invention to have an analysis device reader / communicator **28** which is a  
24 stand-alone unit that reads analysis device **26** and provides that information over the  
25 Internet **18** or some other wired or wireless network adapted to convey such  
26 information or analyze the biological sample "on the spot" providing limited read out  
27 of the presence and / or quantity of the expression of gene or other biological factors,  
28 for example and without limitation, particular proteins and their amount (See Figure

1 1A below). For example, an intranet may be constructed to send and receive such  
2 information among a variety of sites at a large organization. For example, a farmers'  
3 co-operative has particular interest in the health of its crops. Such an organization  
4 would not necessarily use the Internet but would use its own network for the  
5 transmission of such gene expression information when measurements are taken in  
6 the field. In other situations, a cellular network may be used to transmit the desired  
7 information. Analysis device reader **16** reads analysis devices **22, 24** and presents a  
8 digitized, or otherwise transmittable record of the individual gene expression or other  
9 biological information to the PC **14, 20** at the users location. It should be noted that  
10 the "users" location may be a home based unit, a unit in a tractor, or a unit at a  
11 convenient location such as a regional agricultural facility. These PCs will further  
12 comprise software for communicating with the analysis site.

13 It is anticipated that connections to the Internet for reporting of these gene  
14 expression readings will be both wired as in the case of processor **20** connecting to  
15 Internet **18** and wireless as in the case of processor **14** connecting to a wireless  
16 fashion to Internet **18** or via other wireless special purpose devices optimized for the  
17 expression profile reporting of the present invention.

18 The expression profiles will then be provided to an analysis site **12** over a  
19 network such as, and without limitation, the Internet **18** and stored in database **10**  
20 identifying the record only in a numeric fashion in order to preserve the unanimity of  
21 the individual providing the information. Agricultural professionals can report as  
22 many different gene or other biological expressions as desired since those  
23 expressions will vary by the time of day, over a period of years, and with changing  
24 individual conditions. Analysis site **12** receives the information from each individual  
25 and based upon expression, protein, messenger RNA etc. detected, analyze and  
26 compare those results to information stored in the biological database. The analysis  
27 site **12** can create a reading of the gene expression of the plant together with an  
28 interpretation of any particular conditions that might exist.

1 Information relating to the interpretation of the gene expression of the plant is  
2 then provided by analysis site **12** over the Internet **18** back to the individual's  
3 processor **14, 20** for the person's information. Alternatively, information from the  
4 interpretation of the genomic expression can be provided to the user via mail.

5 It is expected, that as analysis device prices decrease, such analysis devices  
6 will be readily available at a reasonable cost to all individuals who desire to use this  
7 process. Furthermore, it is also expected that each plant's genes will be sequenced  
8 (all or in part) which will allow the creation of the "Individualized Analysis Devices."  
9 Those will be used not only to establish the agricultural professional's control and to  
10 obtain the genome expression reading, but also to track any individual changes in  
11 the plant's genes. The difference in the expression of the plant's genes as well as  
12 detection of the specific changes (including but not limited to mutations) may unravel  
13 the condition in the event that the plant is not healthy, at different cycles, and as  
14 other significant events occur which may affect the plant's overall health. All results  
15 from individual analysis device readings will be stored in the biological database for  
16 access by the individual or an agricultural professional over time.

17 It is also suggested by the present invention that the analysis device may be  
18 used for detecting any endemic viral or bacterial gene or other biological expressions  
19 occurring in the plant's physiology, which could result in disease or other malfunction  
20 of the plant.

21 In addition to tracking the plant's expression profiles, by virtue of  
22 understanding each plant's gene expression, treatments can be recommended to an  
23 individual that will be best suited to change or correct that plant's gene expression or  
24 deal with a manifested condition. For example there may be a gene expression,  
25 which pre-disposes a plant to react adversely to certain soils. Thus as part as the  
26 interpretation of the gene and other biological expression of the plant,  
27 recommendations for treatment can be made to the individual. Further, based upon  
28 individual gene expression, "targeted" treatments could be designed which work in  
29 an optimal fashion for the particular plant, as well as target "preventive" treatments.



1        From an economic standpoint, agricultural professionals will be able to  
2        purchase analysis devices **22**, **24**, and **26** at a reasonable cost once these chips are  
3        readily made available to millions of individuals. Each time a reading is interpreted  
4        by the genomic processor the agricultural professional can be charged for that  
5        particular interpretation.

6        It is also anticipated that certain agricultural professional organizations will  
7        want to have their crop's gene expression profile information stored anonymously in  
8        the analysis site database. Storage over the years can also be charged to the  
9        agricultural professional so that the analysis site processor operator can continue to  
10       provide the valuable interpretation and storage services.

11       Referring to Figure 1A, the analysis device reader **16** in a stand-alone mode  
12       (as first noted above) is illustrated. In certain instances and where an individual does  
13       not want to have genomic or other biological factor information transmitted over a  
14       network, a stand-alone analysis device reader **16** can be used. This analysis device  
15       reader uses the analysis device **24** to collect a biological sample. The analysis  
16       device **24** is placed in the analysis device receptacle **70**, which is powered by a  
17       stand-alone power supply **62**. This power supply can be single use or rechargeable  
18       battery supply, and may also be plugged into household current to recharge batteries  
19       or to simply power the stand-alone device.

20       The analysis device reader **16** comprises analysis logic **64** for  
21       interpreting the analysis device readings. Thereafter, the reading may be stored in a  
22       memory **66** in the case where the user wants to have an historical record of readings  
23       over a period of time. The analysis device reader **16** also comprises a screen or  
24       display **68** for providing a limited readout of the presence of or quantity of the biologic  
25       factor or substance being collected by the analysis device **24**. In this fashion, for  
26       example, if a particular biological factor is not present, and this is not troubling for the  
27       user, the results do not have to be sent over a network and risk a disclosure of the  
28       fact that such a test is being conducted by the user. Alternatively, if the results of the

1 readout are such that the user desires to send information, the analysis device  
2 reader also comprises a communication port **68** which may be connected to a  
3 network for transmitting information stored in memory over the network as described  
4 in Figure 1 (above). The display, analysis logic power supply and readout  
5 capabilities are generally disclosed in U.S. Patent No. 5,837,546, which is  
6 incorporated herein in its entirety. However, the capability to analyze the genetic,  
7 proteomic and other biological factors described herein constitutes a novel capability  
8 within the current state-of-the-art.

9 By virtue of the memory in the analysis device **16** certain limited expression  
10 comparisons can be made from one reading to another. When a difference above a  
11 certain threshold occurs between two readings the analysis logic **64** can inform the  
12 user of the detection of that difference via the readout / display **68**. Thereafter, if the  
13 user chooses that information can be sent to an analysis processor (Figure 3, 12) via  
14 the comm. port **68**.

15 Referring to Figure 2 the genophone of the present invention is illustrated.  
16 The genophone **30** is a form of cellular communications device having its own  
17 transceiver **44** connected to the cellular network **45** which in turn subsequently is  
18 linked to analysis processor **12** via a wireless application protocol (WAP) gateway **47**  
19 and thence over the Internet **46** to the analysis site. The characteristics of the WAP  
20 gateway are described in U.S. Patent No. 5,327,529, whose contents are  
21 incorporated herein by reference in their entirety. The linkage to the analysis  
22 processor can also be via the wireless network directly where the analysis center is  
23 capable of receiving an electronic signal from the genophone over its own wireless  
24 transceiver or alternatively the genophone can ultimately connect to an Internet  
25 service provider via a WAP gateway, as noted above, and electronic information  
26 concerning data collected can then be presented to the analysis via the Internet as  
27 described earlier.

28 The genophone has a series of cartridges or readers illustrated as sugar

1 reader **32**, DNA reader **34**, and protein reader **36** although these readers are not  
2 meant as limitations. For example it is fully anticipated that as the bio/genomic  
3 science becomes more refined, other combination readers having this combinations  
4 or others are also anticipated. Each cartridge will have an associated analysis  
5 device illustrated as a sugar chip **38**, a DNA chip **40** and/or a protein chip **42**. As  
6 noted earlier, these chips are not meant as a limitation. Analysis for peptides, small  
7 molecules, hormones, and metabolites are yet further examples, and are not meant  
8 as limiting, of the types of indicators that can be monitored using the present  
9 invention.

10 Referring to Figure 3 a kiosk-oriented embodiment of the present invention is  
11 illustrated. Central to this embodiment for expression profiling is a form of kiosk **60**  
12 which would reside in a more or less public area such as at a regional co-operative,  
13 at offices of the USDA or other locations that provide agricultural assistance. In this  
14 embodiment an individual possessing a credit card or, preferably, a smart card **62**,  
15 which would be associated with a credit card issuer such as VISA®, MasterCard®  
16 and American Express® would have individualized identification information stored,  
17 in encrypted form, on the smart card **62**. An agricultural professional who wishes to  
18 establish a control expression profile for a particular crop or to simply create an  
19 expression profile at that point in time would use the smart card to begin the over all  
20 process of establishing an expression profile in much the same way that an  
21 individual now uses a credit card and automated teller machine to begin a financial  
22 transaction.

23 The individual would insert the smart card **62** in the kiosk **60**. Once  
24 appropriate credit was established with a credit facility **66**, which is the normal type of  
25 electronic credit transaction that establishes that an individual has a certain amount  
26 of credit and has entered the appropriate security information either via a key board  
27 or through some biometric measurement, the kiosk **60** is permitted to perform further  
28 functions.

1           After the kiosk receives the appropriate authorizations from the credit facility  
2     for the financial aspect of the transaction, the kiosk provides analysis device **64** to  
3     the individual. As noted above the analysis device may be a sugar analysis, DNA  
4     analysis, and/or a protein analysis device as appropriate although this is not meant  
5     as a limitation. Analysis for peptides, small molecules, hormones, and metabolites  
6     also occur. The user deposits a biological sample for the crop in question on the  
7     analysis device and reinserts the analysis device into the analysis device reader in  
8     the kiosk. Thereafter an analysis device reader in the kiosk reads the information on  
9     the analysis device in much the same way that individual cartridges read the chip in  
10    the genophone embodiment first noted above. Once the information on the analysis  
11    device is read, the digital information, or other transmittable information, which  
12    characterizes the biological sample is passed over a network to the analysis  
13    processor **12**, which creates the desired expression profile. As noted earlier, the  
14    kiosk itself may be a cellular or wireless device that communicates with the analysis  
15    site in a wireless fashion.

16           Information can be entered, by the user, at the kiosk, regarding the location to  
17    which the information is to be sent. Thus the user can specify that resulting  
18    information be sent to an associated e-mail address, be sent over the mail system to  
19    the user, to be reported via voice or delivered in other ways known to those skilled in  
20    the art.

21           Similar to the genophone noted above, the kiosk can also communicate to the  
22    analysis center over a cellular or other wireless type network. Thus without  
23    limitation, the kiosk can report its results to the analysis via wired network, wireless  
24    networks, cellular networks, and other communications methods known in the trade  
25    including satellite communications as well.

26           Encryption of the resulting data can be accomplished by an appropriate  
27    encryption key stored on the smart card of the agricultural professional and  
28    conveyed to the kiosk for subsequent encryption to the analysis center.

29           As part of the database operations of the present invention, individual

1 expression profile information in a secure fashion. In addition, once specific  
2 conditions are assessed by virtue of expression profile comparison, the analysis  
3 processor of the present invention will review all files in its database and send the  
4 latest health news that relates to the diseases or conditions evidenced by the  
5 expression profiles stored in the database. In this fashion, and individual with, for  
6 example, diabetes, can receive the latest information that breaks relating to this  
7 condition or on the latest equipment available for maintaining a healthy state. Such  
8 information can be delivered via pager, wireless telephone, PDA, and or email.

9 The organization that is responsible for the analysis processor will also  
10 receive notices of research projects requiring test subjects. When such notice is  
11 given, the database of the present invention be searched and, if authorized by the  
12 affected individual, those whose conditions are to be the subject of such medical  
13 research will be provided notice of the need for test subjects. Again, in this fashion  
14 the database will be able to alert those with specific conditions or expression profiles  
15 of the opportunity to participate in such studies.

16 The ramifications of this invention are significant. For example, while DNA,  
17 protein, mRNA, sugars and the like have been mentioned as items to be monitored,  
18 so can small molecules, peptides, hormones and metabolites. These items will also  
19 serve to establish a baseline when the individual is healthy and can later be  
20 monitored as potential precursors to a disease state(s).

21 Further, as the monitoring of the present invention takes place, the information  
22 gleaned can be stored in an anonymous way in a database so that individual  
23 variation can be interpreted not just with respect to other measurements from the  
24 same individual, but can also be interpreted in the context of larger demographic  
25 results.

26 Additionally, monitoring of those individuals undergoing therapy of various  
27 types is very important where there is a possibility of an adverse drug reaction or  
28 where a narrow therapeutic range is desirable for the drug in question. Real time  
29 monitoring of various indicators as noted in the present invention can help to avoid

1 such adverse drug reactions. A genome and biological factor assessment apparatus  
2 and method in alternate embodiments has now been shown. It will be apparent to  
3 those skilled in the art that other applications and businesses can benefit from this  
4 model of DNA chip reading and genome information storage without departing from  
5 the scope of the invention as disclosed.

6

1 I claim:

- 2 1. A system for genomic and proteomic agricultural disease assessment via  
3 expression profile comparison comprising:  
4 a first analysis device for establishing an expression profile and on which is  
5 deposited a first biological sample from an organism;  
6 An analysis device reader for reading biological information from the first  
7 biological sample;  
8 a first network connected to the analysis device reader for transmitting the  
9 biological information;  
10 an analysis processor connected to the network for receiving the biological  
11 information;  
12 storage connected to the analysis processor for storing the biological  
13 information and for storing baseline expression information; and  
14 instructions stored in the analysis processor for comparing the stored  
15 biological information to subsequent biological information.
- 16 2. The system for genomic and proteomic agricultural disease assessment  
17 via expression profile comparison of claim 1 wherein the biological  
18 information is proteomic information.
- 19 3. The system for genomic and proteomic agricultural disease assessment  
20 via expression profile comparison of claim 1 wherein the biological  
21 information is genomic information.
- 22 4. The system for genomic and proteomic agricultural disease assessment  
23 via expression profile comparison of claim 1 wherein the biological  
24 information is genomic information and is taken from the group consisting  
25 of DNA and RNA.
- 26 5. The system for genomic and proteomic agricultural disease assessment  
27 via expression profile comparison of claim 1 wherein the biological  
28 information is information concerning sugars in the biological sample.
- 29 6. The system for genomic and proteomic agricultural disease assessment

1 via expression profile comparison of claim 1 wherein subsequent biological  
2 information comprises a subsequent biological sample from the organism  
3 deposited on a subsequent analysis device at a date subsequent to the  
4 deposit of first biological sample.

5 7. The system for genomic and proteomic agricultural disease assessment  
6 via expression profile comparison of claim 1 wherein the analysis device  
7 reader is connected to the network via a personal computer.

8 8. The system for genomic and proteomic agricultural disease assessment  
9 via expression profile comparison of claim 1 wherein the analysis device  
10 reader is connected to the network via a wireless device.

11 9. The system for genomic and proteomic agricultural disease assessment  
12 via expression profile comparison of claim 8 wherein the wireless device is  
13 a genophone.

14 10. The system for genomic and proteomic agricultural disease assessment  
15 via expression profile comparison of claim 9 wherein the genophone  
16 comprises an analysis device reader and a wireless transceiver connected  
17 to a second network for transmitting the biological information in a wireless  
18 mode to the first network.

19 11. The system for genomic and proteomic agricultural disease assessment  
20 via expression profile comparison of claim 1 wherein the first network is a  
21 wireless network.

22 12. The system for genomic and proteomic agricultural disease assessment  
23 via expression profile comparison of claim 1 wherein the analysis device  
24 reader is located in a kiosk and wherein the kiosk is connected to a credit  
25 facility for processing credit request for use of the analysis device reader.

26 13. The system for genomic and proteomic agricultural disease assessment  
27 via expression profile comparison of claim 12 wherein access to the kiosk  
28 is made via a token associated with a particular user.

29 14. The system for genomic and proteomic agricultural disease assessment



- 1 via expression profile comparison of claim 13 wherein the token is a smart  
2 card.
- 3 15. The system for genomic and proteomic agricultural disease assessment  
4 via expression profile comparison of claim 13 wherein the token is a credit  
5 card.
- 6 16. The system for genomic and proteomic agricultural disease assessment  
7 via expression profile comparison of claim 13 wherein the token is a stored  
8 value card.
- 9 17. The system for genomic and proteomic agricultural disease assessment  
10 via expression profile comparison of claim 1 wherein instructions stored in  
11 the analysis processor further comprise instructions for creating a first  
12 expression profile from the biological information.
- 13 18. The system for genomic and proteomic agricultural disease assessment  
14 via expression profile comparison of claim 17 wherein instructions stored in  
15 the analysis processor further comprise instructions for creating a  
16 subsequent expression profile from the subsequent biological information  
17 and for comparing the first expression profile to the subsequent expression  
18 profile to detect disease and genetic conditions.
- 19 19. A method of genomic and proteomic agricultural disease assessment via  
20 expression profile comparison comprising:  
21 establishing a baseline expression profile at a first date;  
22 storing the expression profile in an analysis center;  
23 creating a subsequent expression profile at a date later than that of the  
24 baseline expression profile;  
25 comparing the subsequent expression profile to the baseline expression  
26 profile; and  
27 assessing physiological conditions based upon the comparison.
- 28 20. The method of genomic and proteomic agricultural disease assessment  
29 via expression profile comparison of claim 19 wherein establishing a

- 1 baseline expression profile comprises depositing a biological sample on a  
2 first analysis device;  
3 reading the analysis device in an analysis device reader; and  
4 transmitting the analysis device reader results over a network to an  
5 analysis center.
- 6 21. The method of genomic and proteomic agricultural disease assessment  
7 via expression profile comparison of claim 20 wherein the network is the  
8 Internet.
- 9 22. The method of genomic and proteomic agricultural disease assessment  
10 via expression profile comparison of claim 20 wherein the network is a  
11 wireless network.
- 12 23. The method of genomic and proteomic agricultural disease assessment  
13 via expression profile comparison of claim 20 wherein the analysis device  
14 reader is connect to a personal computer; and wherein the personal  
15 computer is connected to the network.
- 16 24. The method of genomic and proteomic agricultural disease assessment  
17 via expression profile comparison of claim 20 wherein the analysis device  
18 reader is a wireless device for reading the analysis device and for  
19 transmitting the analysis device reader results in a wireless mode to the  
20 analysis center.
- 21 25. The method of genomic and proteomic agricultural disease assessment  
22 via expression profile comparison of claim 20 wherein the biological  
23 sample is taken from the group consisting of secretion, metabolites, juices,  
24 and fluids.
- 25 26. The method of genomic and proteomic agricultural disease assessment  
26 via expression profile comparison of claim 19 wherein the analysis device  
27 reader results comprise genomic information.
- 28 27. The method of genomic and proteomic agricultural disease assessment  
29 via expression profile comparison of claim 19 wherein the analysis device

- 1 reader results comprise proteomic information.
- 2 28. The method of genomic and proteomic agricultural disease assessment  
3 via expression profile comparison of claim 19 wherein the analysis device  
4 reader results comprise sugars in the biological sample.
- 5 29. The method of genomic and proteomic agricultural disease assessment  
6 via expression profile comparison of claim 19 wherein creating a  
7 subsequent expression profile comprises depositing a biological sample on  
8 a subsequent analysis device;  
9 reading the subsequent analysis device in an analysis device reader; and  
10 transmitting the analysis device reader results for the subsequent analysis  
11 device over a network to the analysis center.
- 12 30. The method of genomic and proteomic agricultural disease assessment  
13 via expression profile comparison of claim 20 wherein the analysis  
14 comprises instructions stored in memory for comparing the subsequent  
15 expression profile to the baseline expression profile.
- 16 31. The method of genomic and proteomic agricultural disease assessment  
17 via expression profile comparison of claim 20 wherein the analysis device  
18 reader is located in a kiosk and wherein the kiosk is connected to a credit  
19 facility for processing credit request for use of the analysis device reader.
- 20 32. The method of genomic and proteomic agricultural disease assessment  
21 via expression profile comparison of claim 20 wherein the kiosk is made  
22 available via a token associated with a particular user.
- 23 33. The method of genomic and proteomic agricultural disease assessment  
24 via expression profile comparison of claim 20 wherein the token is a smart  
25 card.
- 26 34. The method of genomic and proteomic agricultural disease assessment  
27 via expression profile comparison of claim 20 wherein the token is a credit  
28 card.
- 29 35. The method of genomic and proteomic agricultural disease assessment

- 1 via expression profile comparison of claim 20 wherein the token is a stored  
2 value card.
- 3 36. The method of genomic and proteomic agricultural disease assessment  
4 via expression profile comparison of claim 20 wherein the biological  
5 information is genomic information and is taken from the group consisting  
6 of DNA and mRNA.
- 7 37. The method of genomic and proteomic agricultural disease assessment  
8 via expression profile comparison of claim 19 wherein the analysis device  
9 reader results comprise hormones.
- 10 38. The method of genomic and proteomic agricultural disease assessment  
11 via expression profile comparison of claim 19 wherein the analysis device  
12 reader results comprise peptides.
- 13 39. The method of genomic and proteomic agricultural disease assessment  
14 via expression profile comparison of claim 19 wherein the analysis device  
15 reader results comprise metabolites.
- 16 40. The method of genomic and proteomic agricultural disease assessment  
17 via expression profile comparison of claim 19 wherein the analysis device  
18 reader results comprise enzymes.
- 19 41. The method of genomic and proteomic agricultural disease assessment  
20 via expression profile comparison of claim 19 wherein the analysis device  
21 reader results comprise antibodies.
- 22 42. The method of genomic and proteomic agricultural disease assessment  
23 via expression profile comparison of claim 20 wherein the analysis device  
24 is a microarray.
- 25 43. The method of genomic and proteomic agricultural disease assessment  
26 via expression profile comparison of claim 20 wherein the analysis device  
27 is a fiber optic probe comprising a plurality of sensors.
- 28 44. The method of genomic and proteomic agricultural disease assessment  
29 via expression profile comparison of claim 20 wherein the analysis device

- 1 is a semiconductor microchip.
- 2 45. The method of genomic and proteomic agricultural disease assessment  
3 via expression profile comparison of claim 20 wherein the analysis device  
4 is a cartridge comprising a semiconductor microchip.
- 5 46. The method of genomic and proteomic agricultural disease assessment  
6 via expression profile comparison of claim 20 wherein the analysis device  
7 utilizes electron concentration and hybridization technology.
- 8 47. The method of genomic and proteomic agricultural disease assessment  
9 via expression profile comparison of claim 20 wherein the analysis device  
10 comprises a microfabricated capillary electrophoresis chip.
- 11 48. The method of genomic and proteomic agricultural disease assessment  
12 via expression profile comparison of claim 20 wherein the analysis device  
13 comprises a centripetal acceleration microsystem platform.
- 14 49. The system for genomic and proteomic agricultural disease assessment  
15 via expression profile comparison of claim 1 wherein the biological  
16 information is hormonal information.
- 17 50. The system for genomic and proteomic agricultural disease assessment  
18 via expression profile comparison of claim 1 wherein the biological  
19 information is peptide information.
- 20 51. The system for genomic and proteomic agricultural disease assessment  
21 via expression profile comparison of claim 1 wherein the biological  
22 information is metabolite information.
- 23 52. The system for genomic and proteomic agricultural disease assessment  
24 via expression profile comparison of claim 1 wherein the biological  
25 information is enzyme information.
- 26 53. The system for genomic and proteomic agricultural disease assessment  
27 via expression profile comparison of claim 1 wherein the biological  
28 information is antibody information.
- 29 54. The system for genomic and proteomic agricultural disease assessment

1 via expression profile comparison of claim 1 wherein the analysis device is  
2 a microarray.

3 55. The system for genomic and proteomic agricultural disease assessment  
4 via expression profile comparison of claim 1 wherein the analysis device is  
5 a fiberoptic probe comprising a plurality of sensors.

6 56. The system for genomic and proteomic agricultural disease assessment  
7 via expression profile comparison of claim 1 wherein the analysis device is  
8 a semiconductor chip.

9 57. The system for genomic and proteomic agricultural disease assessment  
10 via expression profile comparison of claim 1 wherein the analysis device is  
11 a cartridge comprising a semiconductor chip.

12 58. The system for genomic and proteomic agricultural disease assessment  
13 via expression profile comparison of claim 1 wherein the analysis device  
14 comprises electronic concentration and hybridization technology.

15 59. The system for genomic and proteomic agricultural disease assessment  
16 via expression profile comparison of claim 1 wherein the analysis device is  
17 a microfabricated capillary electrophoresis chip.

18 60. The system for genomic and proteomic agricultural disease assessment  
19 via expression profile comparison of claim 1 wherein the analysis device  
20 comprises a centripetal acceleration microsystem platform.

21 61. A system for genomic and proteomic agricultural disease assessment via  
22 expression profile determination comprising:  
23 an analysis device for collecting a biological sample;  
24 an analysis device reader adapted to create a reading from the analysis  
25 device, the analysis device reader comprising;  
26 an analysis device receptacle for receiving and creating the analysis  
27 device reading from the contents of the analysis device;  
28 a power supply connected to the analysis device receptacle for providing  
29 power to the receptacle;

- 1 a processor comprising analysis logic for receiving the results of the  
2 reading from the analysis device and for creating a record of the results;  
3 memory connected to the analysis processor for receiving the record of the  
4 results; and  
5 a display connected to the processor for displaying the record of results.
- 6 62. The system for genomic and proteomic agricultural disease assessment  
7 via expression profile determination of claim 61 wherein the record of  
8 results comprises a first expression profile.
- 9 63. The system for genomic and proteomic agricultural disease assessment  
10 via expression profile determination of claim 62 wherein the processor  
11 further comprises logic for comparing the first expression profile to a  
12 second expression profile and for alerting a user via the display of the  
13 presence of any differences between the expression profile and the  
14 subsequent expression profile.
- 15 64. The system for genomic and proteomic agricultural disease assessment  
16 via expression profile determination of claim 61 further comprising a  
17 communications port for transmitting the record of results over a network.
- 18 65. The system for genomic and proteomic agricultural disease assessment  
19 via expression profile determination of claim 64 where the network is  
20 selected from the group consisting of wireless networks, the Internet, an  
21 intranet, and wireless local loop network.
- 22 66. The system for genomic and proteomic agricultural disease assessment  
23 via expression profile determination of claim 61 wherein the analysis  
24 device is adapted to detect hormones and the record of results is hormonal  
25 information.
- 26 67. The system for genomic and proteomic agricultural disease assessment  
27 via expression profile determination of claim 61 wherein the analysis  
28 device is adapted to detect peptides and the record of results is peptide  
29 information.

- 1       68.    The system for genomic and proteomic agricultural disease assessment  
2            via expression profile determination of claim 61 wherein the analysis  
3            device is adapted to detect metabolites and the record of results is  
4            metabolite information.
- 5       69.    The system for genomic and proteomic agricultural disease assessment  
6            via expression profile determination claim 61 wherein the analysis device  
7            is adapted to detect enzymes and the record of results is enzyme  
8            information.
- 9       70.    The system for genomic and proteomic agricultural disease assessment  
10            via expression profile determination of claim 61 wherein the analysis  
11            device is adapted to detect antibodies and the record of results is antibody  
12            information.
- 13      71.    The system for genomic and proteomic agricultural disease assessment  
14            via expression profile determination of claim 61 wherein the analysis  
15            device is selected from the group consisting of a microarrays, a fiberoptic  
16            probe comprising a plurality of sensors, a semiconductor chip, a cartridge  
17            comprising a semiconductor chip, an electronic concentration and  
18            hybridization technology device, and a microfabricated capillary  
19            electrophoresis chip.
- 20      72.    A method of genomic and proteomic agricultural disease assessment via  
21            expression profile determination comprising:  
22            establishing a first expression profile at a first date by depositing a  
23            biological sample on an analysis device;  
24            reading the analysis device in an analysis device reader, the analysis  
25            device reader comprising an analysis device receptacle for receiving the  
26            analysis device, and analysis processor and associated memory, and  
27            interconnected power supply, and display ;  
28            analyzing the reading from the analysis device in the analysis processor;  
29            displaying the analysis results on the display;



- 1 storing the analysis results in a memory associated with  
2 reading the analysis device processor.
- 3 73. The method of genomic and proteomic agricultural disease assessment  
4 via expression profile determination of claim 72 wherein the biological  
5 sample is taken from the group consisting of hormones, peptides,  
6 metabolites, enzymes, antibodies, genes proteins sugars, DNA and RNA.
- 7 74. The method of genomic and proteomic agricultural disease assessment  
8 via expression profile determination of claim 72 wherein the analysis  
9 device is taken fro the group consisting of a microarrays, fiberoptic probe  
10 comprising a plurality of sensors, semiconductor chips, cartridges  
11 comprising a semiconductor chip, electronic concentration and  
12 hybridization technology devices, centripetal acceleration microsystem  
13 platforms, and microfabricated capillary electrophoresis chips.
- 14 75. The method of genomic and proteomic agricultural disease assessment  
15 via expression profile determination of claim 74 wherein the analysis  
16 device is adapted to provide readings from biological samples from the  
17 group consisting of hormones, peptides, metabolites, enzymes, antibodies,  
18 genes proteins sugars, DNA and RNA.  
19

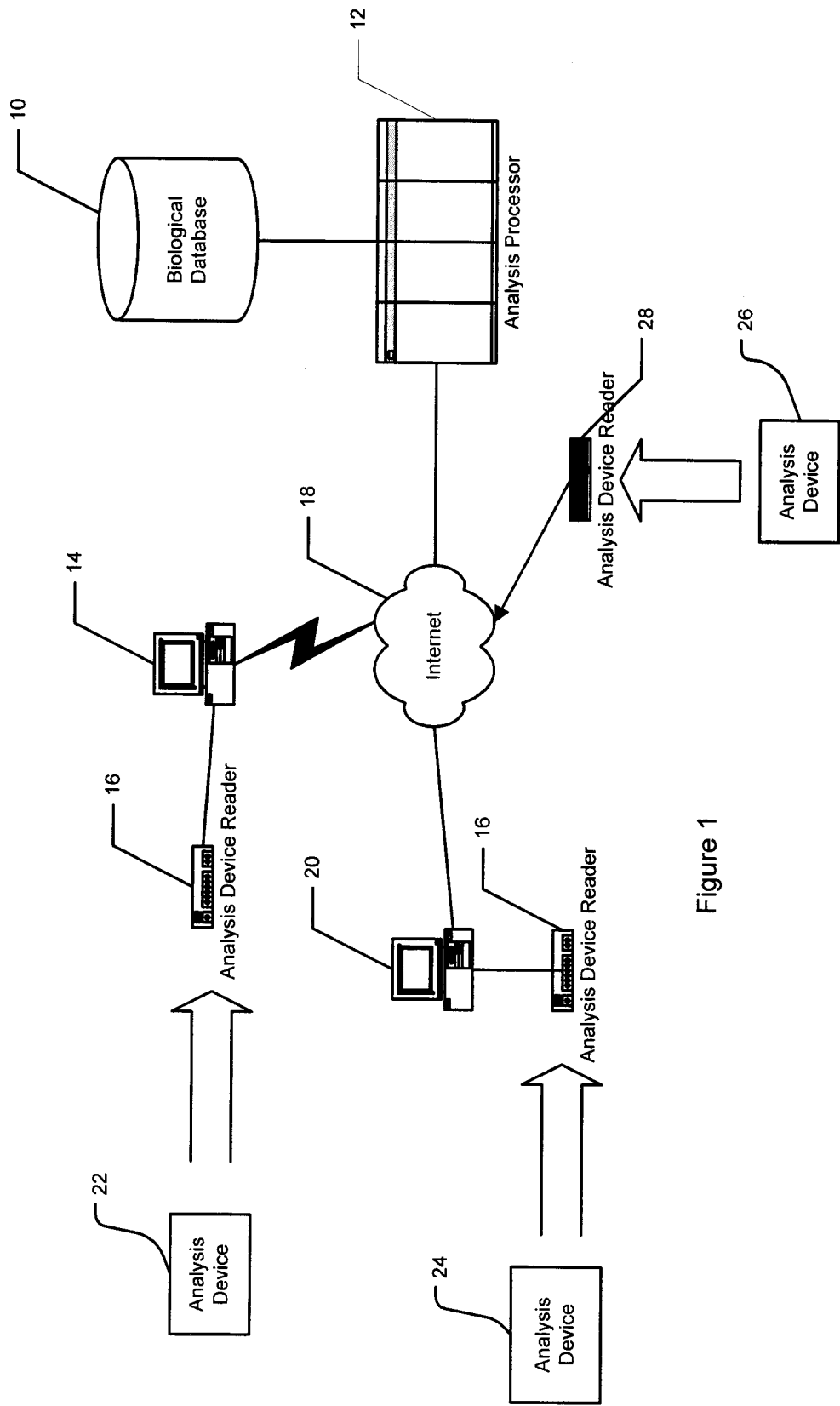
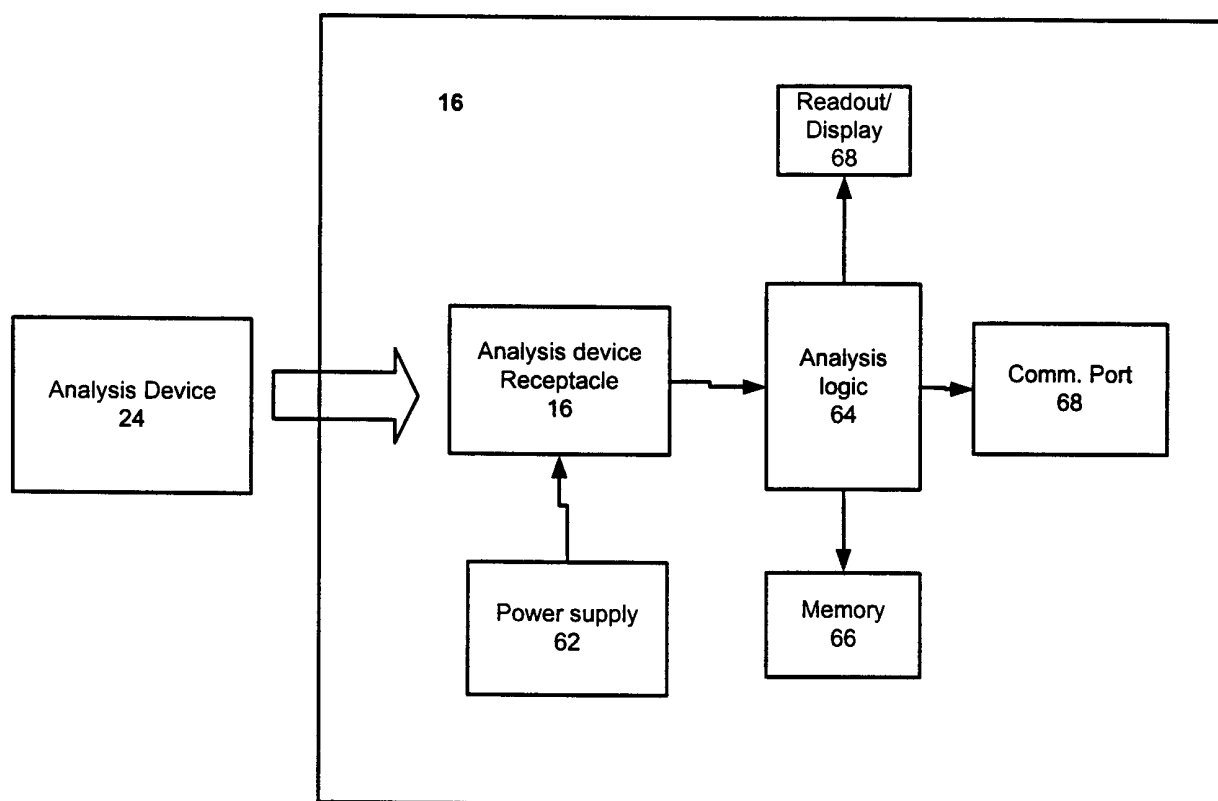


Figure 1

**Figure 1A**

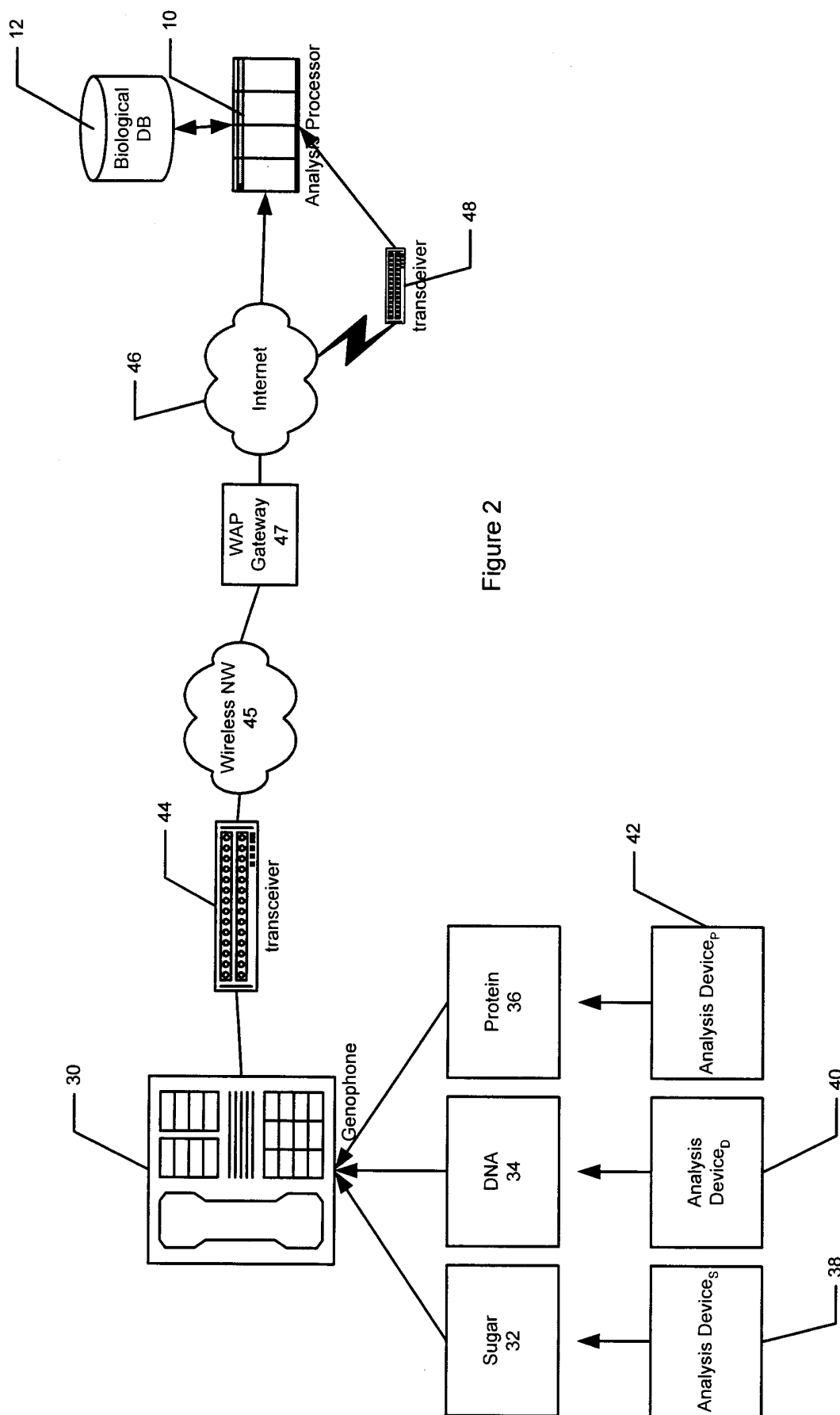


Figure 2

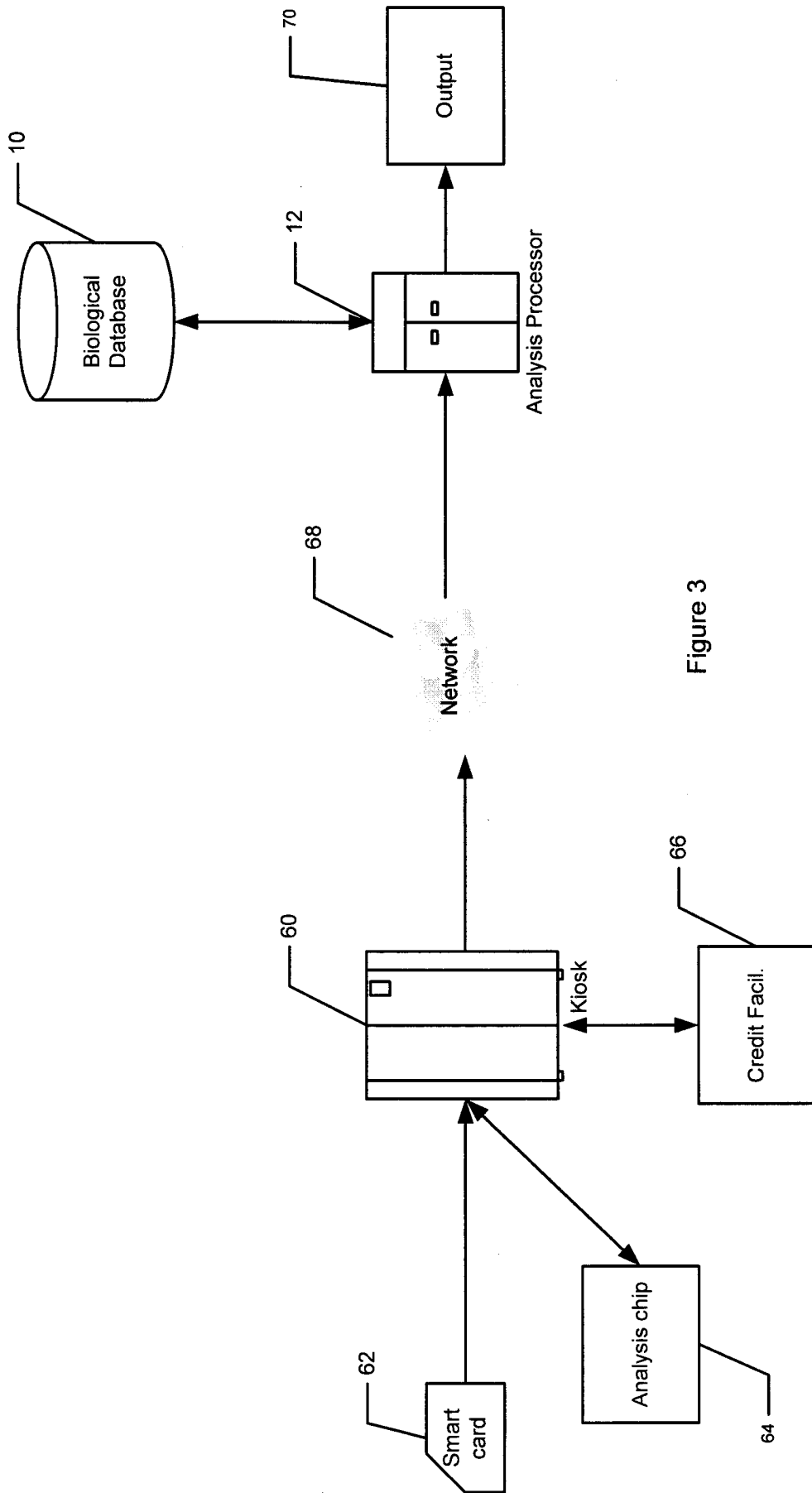


Figure 3