Manthan

A Quarterly Magazine Published by BiharBrains

July, 2009

Manthan

July, 2009

Contents

ISSN No. 0974-6331, Volume 9

1. From Editor's Desk 1

2. Research Articles

2.1 Analytical Study of Devices for Conversion of Solar Energy into Electrical Energy 2
k. B. Singh, Baby Sarika, H. L. Shah, A. K. Mishra, Patna, Darbhanga, Muzaffsrpur, Motihari, India

2.2 Digital Image Stabilization by Adaptive Phase Correlation Motion Vectors Filtering 6
Bibhuti Bikaramaditya, Ohyun Kwon, Joonki Paik, Seoul, South Korea

3. General Articles

3.1 Nucleic Acid Therapeutics 10
Pramod Yadava, New Delhi, India

3.2 Human Development- Necessity of Grassroots Approach 12
Indra R. Sharma, New Delhi, India

3.3 Nano-Medicine and Drug Development 14
Mohammad Abul Farah, Gwangju, South Korea

3.4 The Genes for Cancer 16
Jawed Ahmad, Hyderabad, India

3.5 Basics of Radiocarbon Dating 18
Kumud Kumari and Brajesh kumar, Patna, India

3.6 Uranium-Uranium Dating 20
Kumud Kumari and Brajesh kumar, Patna, India

3.7 Do We Have Enough Forest? A Review of Conventional Wisdom 22
Kumkum Sinha and Sudha Upadhaya, Ranchi, India

Manthan is a quarterly magazine published by BiharBrains, an international Forum of educated people of Bihar with the objectives of sharing ideas, knowledge and achievements which can be benefited to the scientific and non-scientific community.

Publishing Office
Biharbrains Scholastic Centre,
201, OmVihar Apartment
Opp Hotel Apsara
Kadam Kuan, Patna, India
Tel:+91-612-3258716
Email : bbmanthan@gmail.com
Web : www.bbmanthan.info

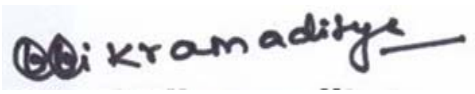
Cover page design and magazine layout prepared by
Mohammad Abul Farah
Gwangju, South Korea

Editor's Desk

Generally accepted concepts of the use and value of forestry have changed greatly in the past 20 years. For many years forests were seen as vital for production and industrialization and were a strong link to general economic development. As more scientific information about global warming accumulates, climate change is emerging as perhaps the greatest environmental challenge of the twenty-first century. What is more, a virtual Pandora's box of major global threats, such as hunger, poverty, population growth, armed conflict, displacement, air pollution, soil degradation, desertification and deforestation are intricately intertwined with and all contribute to climate change, necessitating a comprehensive approach to a solution. This issue has covered an interesting article on the importance of forests and its conservation by implementing multifaceted strategies for sustainable development.

Articles in this issue of Manthan has been divided in two broad catagories; Research articles and General articles covering all the area interest as that of earlier issues. The research article section in this issue is focused on developing renewable or non-conventional sources of energy and development of digital image stabilization algorithm to improve the visual quality efficiently.

We solicit your reactions, comments and suggestions in the mailbox and expect that with your help and support in future, this magazine will grow into a versatile platform.
For details you are free to visit our website www.bbmanthan.info.



Bibhuti Bikramditya
Chief Editor

Manthan, International Journal, Vol. 9, July, 2009, ISSN No. 0974-6331

Manthan

Analytical Study of Devices for Conversion of Solar Energy into Electrical Energy

K. B. Singh, Baby Sarika[&], H. L. Sah[*], A.K. Mishra[+]

Deptt. of Physics, Govt. Polytechnic, Darbhanga, Bihar, India.
[&] Deptt. of Chemistry, Women's Polytechnic,patna, Bihar.
[*]University Deptt. of Physics, B.R.A.Bihar University , Muzaffarpur, Bihar
[+] P.U.P.College, Motihari, Bihar
e-mail: kbsphysics@yahoo.co.in

Abstract

Energy crisis is the burning problem before the nation. Conventional sources are being exhausted day to day. It is essential to search out the alternative sources of renewable or non-conventional sources of energy of the development of the nation. The present study is concentrated to the different devices useful for conversion of solar energy into electrical power with different conversion efficiencies.

Keywords: Conventional energy, Non-conventional energy, Bio-mass, Nuclear fission.

1. Indroduction

As there is crisis of energy available from conventional sources, which are being consumed at faster rate today, it is useful step for searching out alternative sources of non-conventional or renewable energy. There are many sources of conventional energy such as - (i) Nuclear fission, (ii) Bio-mass, (iii) Wind & (iv) Sun etc.

Out of so many sources, Sun is supposed to be the vast ocean of radiation. So it is very much wise step to harness the solar radiation useful for the need of mankind and also for the development of the nation. Whole world today is thinking for the conversion of solar radiation into electrical power due to certain characteristics of the solar radiation. Many countries have developed different devices useful for the conversion of such radiation into electrical power with different amount of conversion efficiencies. These conversion devices are called solar cells, which are categorized as (i) dry solar cell & (ii) wet solar cell.

I. Dry Solar Cells are as follows:

(i) PN jn Si Solar Cell
(ii) Cadmium Sulphide (CdS) solar cells - Thin film solar cell
(iii) Gallium Arsenide (GaAs) solar cell
(iv) Thermoelectric solar cell
(v) Thermo ionic solar cell
(vi) Schottky barrier solar cell.

II. Wet Solar Cell is as follows:

Photo electrochemical (PEC) solar cell - This PEC solar cell uses different electrode materials such as Tungston Oxide (WO_3), TinOxide (SnO_2), AlSb, CdS etc.

In this paper we concentrate our study only on the dry Solar cells.

2. Solar Cells:

In dry solar cell no any chemical liquid is used. The principle of conversion of solar radiation is based on the laws of photo electricity. Solar cells are (i) photo voltaic, (ii) photo conductive & (iii) photo emission cells. These cells are designed to convert sunlight into electrical power, which is delevered, to a suitable load in an efficient manner. The advantages of these solar cells lie in their ability to provide nearly permanent, uninterrupted power at no operating cost with only heat as a waste product & their conversion of light directly in to electricity. Solar cell consists of semiconductor single crystal or polycrystalline wafer having a very thin diffused region at its surface to form a P-N junction. When light falls on a solar cell then photo voltage develops across the terminal of the solar cell causing an electrical current to flow in the external circuit. (Shown in figure 1).

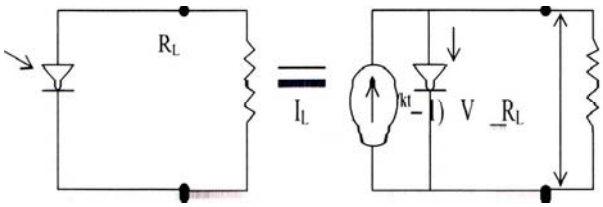


Fig 1: Equivalent circuit of a solar cell

The performance of the cell depends on:

(i) Open circuit voltage (Voc) - The open circuit voltage is the output voltage when the load impedance is much greater than the device impedance.

(ii)Short circuit current density (Isc) - The short circuit current density is the output current per unit area

When the load impedance is much smaller than the device impedance.

(iii)Conversion efficiency (h) & fill factor (FF) - The fill factor (FF) is the ratio of maximum output power to the product of the open circuit voltage and short circuit current.

(iv) Materials of desired energy band gap.

The performance of of solar cell depends on the material used along with the design of the solar cell.

2.1.P-N Junction Si Solar Cell:

The Si p-n jn. Solar cell serves as a reference device for all solar cells. For satellite and space vehicle flat-plat Si solar cells are the most important long duration power supply. The most widely used and technically developed type of solar cell is the Silicon cell. Its popularity stems not from its scientific excellence but from the fact that it builds on the extensive solid-state technology and manufacturing experience of the semiconductor industry. Silicon is chemically stable and yields cells of long lifetime potential in the earth's environment. Most commercial cells yields 10% conversion efficiency; some now approach 15% in reliable quantities. The silicon solar cell as shown in cross section in fig.2. Single crystal silicon of ultra-high purity is doped through its bulk with arsenic to produce n- type silicon. The surface of a wafer is subsequently doped with boron to produce p-type silicon. This type of cell is called a pn-junction solar cell. One can also reverse the types, yielding an np-junction solar cell.

.

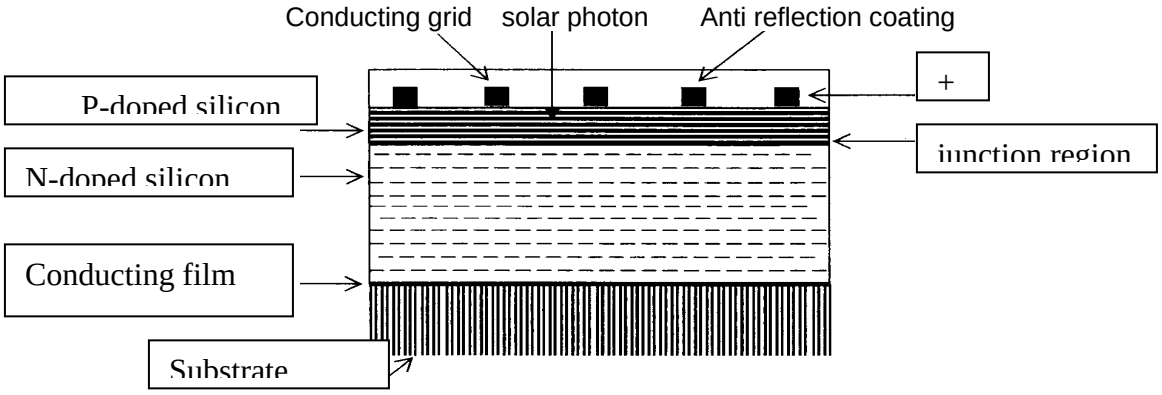


Fig: 2 Schematic cross section of a silicon solar cell.

The variation of sensitivity with wavelength for silicon solar cells is determined by a number of competing effects. The extra cutoff in the infrared and the blue can be adjusted in manufacture by varying appropriate physical parameters. The opacity of silicon changes rapidly with wavelength and consequently the depth of placement of the junction below the surfaces of the silicon have much to do with the spectral sensitivity.

Relative resistivity

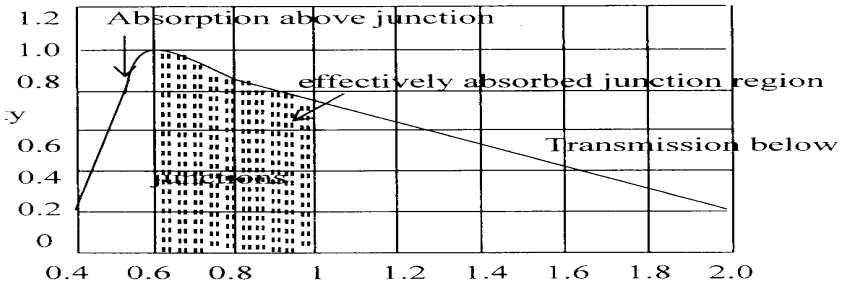


Fig2a: Spectral sensitivity of a silicon solar cell.

2.2. Cadmium Sulphide (CdS) Solar Cell

Next to silicon, the material that has attracted most of the international research effort is cadmium sulphate (CdS), which exhibits the good conversion efficiencies when employed in association wirth copper sulphide (Cu_2S) as CdS-Cu_2S hetrojunction. In 1974, the commercial production of CdS solar cells was projected for the first time. The technology to be employed is a front wall cell. It consists of a substrate on which a 20 mm thick CdS layer is vaporated with a thin Cu_2S film on top of it. The whole is hermetically sealed in a glass encapsulation. Promising development work is also currently under way on a modified CdS-Cu_2S structure whose schematic cross-section shown in fig.3.

The open circuit voltage CdS are in the 400-500 mV range, which is lower than for silicon cell. Short circuit currents comparable to those observed in conventional silicon cells have been reported. The maximum efficiency obtained in the laboratory is between 8% and 8.5 %, but 5% efficiency is more typical of the small production units which have been operated so far.

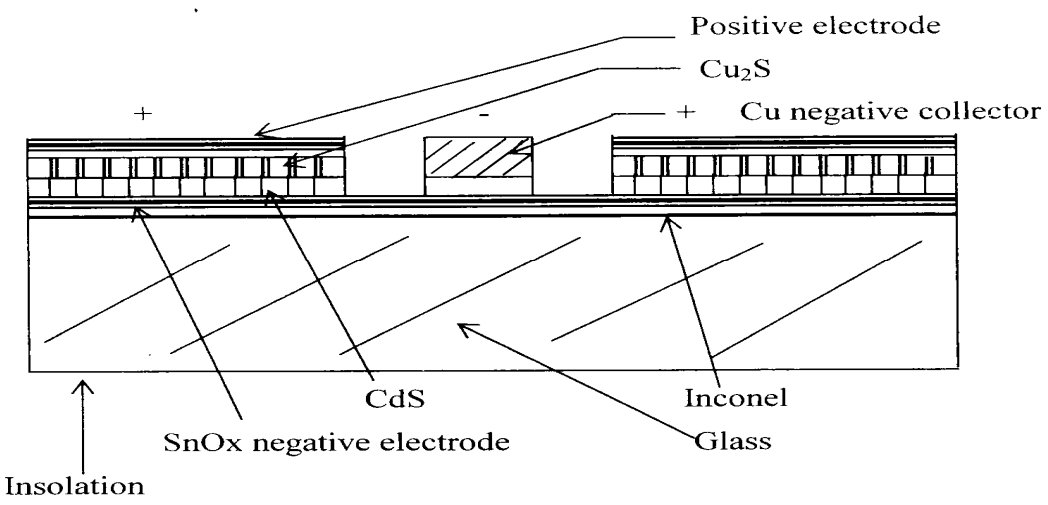


Fig 3: Schematic cross section through a low cost CdS solar cell.

2.3. Gallium Arsenide Solar Cell:

The third type of cell, which should be mentioned briefly at this point, is the GaAs solar cell. In the form of polycrystalline form like the presents silicon cells, high conversion efficiencies can be obtained. Efficiencies of 13% have been demonstrated and some source quote 19%. At ground illumination (AMI) the maximum theoretical efficiency is about 27%, higher than for silicon solar cell.

2.4. Thermo Electric Solar Cell

A thermo electric solar cell is one in which a current is generated as the result of the voltage appearing at the junctions of two dissimilar metals. When one set of junction is maintained at a different temperature than the other. The ability of metal to generate this voltage is given by the See beck's coefficient. Any two metals produce a See beck's coefficient, but by careful selection one can greatly increase the effect. The cell structure is shown in fig 4.

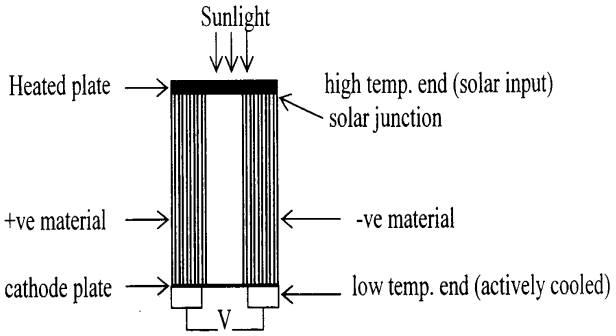


Fig 4: Thermo electric junction materials of different Seebeck's coefficients.

2.5.Thermo ionic Solar Cell

Heated metal surface in a vacuum enclosure will emit electrons, forming a space charge about the heated surface. If a second plate of metal at a lower temperature is placed in the same vacuum enclosure, an electric current will flow from the hot to the cold plate. The thermo ionic cell is therefore a vacuum tube designed to accentuate this effect to a point where

Ip

practical amounts of power can be extracted from the device.

3. Solar Cell equivalent circuit:

By connecting a load across the terminal of a solar cell a current I_L can flow through the load and develop a voltage V_L and I_L, besides depending on the nature of load, will be related to the photo generated current I_P and the properties of the diode.

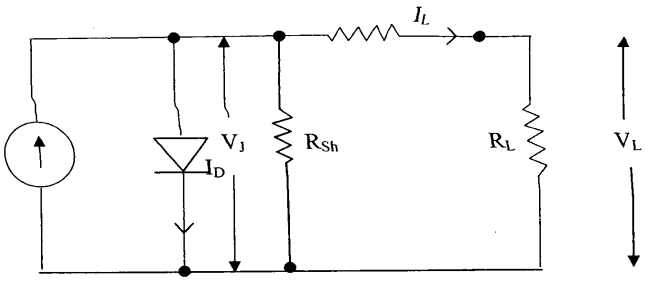


Fig 5: Simple equivalent circuit of a solar cell

This relationship can be established by reference to the simple equivalent circuit where imperfections in the diode loading to current leakage are represented by a shunt resistance R_{SH} and parasitic series resistance effects are represented by Rs.

$$I_L(1+ Rs/R_{SH}) = I_P - I_D(Vj) - V_L/ R_{SH} \quad .....(1)$$

The equivalent circuit of the cell is shown in fig 5.The actual operating point on a given solar cell I-V characteristics is determined by the value of the load resistance R_L and it is clearly desirable to choose R_L such that biasing occurs at the maximum power point Im, Vm. The energy conversion efficiency can then be described by

$$n= I_mV_m/Pi.a= \text{maximum output power/ power incident on the cell}$$

The ratio of (I_mV_m) to $(I_{SC}\ V_{OC})$ is defined as the fill factor, which enables a further expression for h to be written as

$$n= (FF.Isc.\ Voc)/\ Pi.a \quad .....(2)$$

Where I_{SC} is the maximum possible value of the photo current and V_{OC} is the maximum possible value of photo voltage

Conclusions:

The study of different devices of conversion of solar radiation into electrical power enables us to design and fabricate the inexpensive solar cells. For this purpose attention is to be given to quest the suitable materials available in abundance in nature & conveniently obtained an cheaper rate.

References:

1.S.M. Sze- "Physics of Semi-conductor Devices" Willey Eastern limited, Delhi, 1987. PP 790 to 837.

2.DC Reynold etal-"Photovoltaic Effect in Cadmium Sulphide" phy. Rev 96.533 (1954)

3.C.E. Bookus- "Solar Cell", IEEE Press, Newyork, 1976.

4.M.P. Jhekaekara-"Data as incident Solar Energy", Suppl. PROC, 20th Annual Meet, Inst. Environ, see pP21, 1974

5.K.J. Backmann-" Material Aspects of Solar Cells", Current technique in material science, Vol 3. North Halland, Armesterdam, 1979.

6.M.K. Saran-" Prepration and Characterization of WO_3- PEC solar cell (1984)

7.A. Fuzishumaetal-"Electrochemical Photolysis of water at semiconductor elecrtrode" Nature (London) 37, 2381 (1972)

8.J.F. Kreiders- "Solar Energy Hand book", IIT Kanpur.

9.H.L.Sah, K.B.Singh et al: "Study of the mechanical, Electrical & magnetic properties pof a SnO PEC Solar Cell" Thesis 2003.

Manthan, International Journal, Vol. 9, July, 2009, ISSN No. 0974-6331

Manthan

Digital Image Stabilization by Adaptive Phase Correlation Motion Vectors Filtering

Bibhuti Bikramaditya [1], Ohyun Kwon[1,2], Joonki Paik [1],

[1]Image Processing and Intelligent Systems Laboratory, Department of Image Engineering, Graduate School of Advanced Imaging Science, Multimedia, and Film, Chung-Ang University, 221 Huksuk-Dong, Tongjak-Ku, Seoul 156-756, Korea, http://ipis.cau.ac.kr

[2]nSYSTechnologies Co.Ltd, 1301, Mario-tower,222-12 Guro-dong, Guro-gu, Seoul 135-841, Korea, http://www.nsystech.com

Abstract

This paper proposes digital image stabilization with sub-image novel phase correlation based global motion estimation and maximum peak filtering based motion correction. Global motion is estimated from the local motion of four sub-images each of which is detected using phase correlation (PC) based motion estimation. The correlation surface using Phase correlation techniques determine local motion vector (LMV) and most peak amplitude from block of LMV decides its global motion vector (GMV), thereby Accumulating motion vector (AMV) for panning. The proposed algorithm can make a robust digital image stabilization when camera affected by vibration or unwanted movement. Experimental results show that the proposed digital image stabilization algorithm can efficiently remove the unwanted displacement.

1. INTRODUCTION

The unwanted movements and vibration caused by hand tremble and heartbeat may affect digital image while using digital camcorder and digital camera. An unwanted movement in the camera shot often causes an incorrect superposition of the current and reference images as well as destructive consequences for typical change-detection algorithms. Compact consumer video cameras with powerful zooms are likely to results in the fluctuation of images to the hand movements, and various digital image stabilizing systems have been developed to improve the visual quality through stabilization process [1].

The digital image stabilization system can be divided into two parts: the global motion estimation system and the motion correction system. The motion estimation system is responsible for the estimation of interframe global motion vectors, which are forwarded to the motion correction system. The motion correction system accomplishes the stabilization of the image sequence according to the global motion model or objective. A review and brief comparison of already proposed global motion estimation and motion correction techniques are analyzed.

Various digital image-stabilizing systems have been developed for camcorders free from degradation in picture quality by hand movement. The digital image stabilizer consists of the motion estimating system and the motion correction system. Most often, the motion estimation based on block matching algorithm [2] [3] [4] and phase correlation algorithm are being proposed for the same [5] [6]. In block matching, for computationally efficient image stabilization algorithms that represent point matching [3], edge pattern matching [2], grey-coded bit-plane matching [1], and block motion vectors filtering have been developed. However, block matching is not good results on without pattern image. Therefore, we use phase correlation for motion estimation.

In this paper, we propose a digital image stabilization with sub-image novel phase correlation based global motion estimation and maximum peak filtering based motion correction. Global motion is estimated from the local motion of four sub-images each of which is detected using phase correlation (PC) based motion estimation. Concretely among local motion vector (LMV), filter find most peak from phase correlation each blocks and set this LMV to global motion vector (GMV). And then make accumulated motion vector (AMV) for panning.

This paper is organized as follows: In Sec. 2, we summarize the sub-image phase correlation based global motion estimation algorithm. Motion correction using good filter algorithm described in Sec. 3. Experimental results and conclusions are respectively given in Sec. 4 and 5.

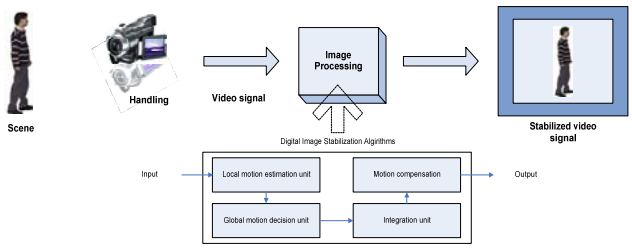


Figure 1 Block diagram of digital image stabilization system.

2. MOTION ESTIMATION BY PHASE CORRELATION

5.1. Phase correlation methods

The idea behind this method is quite simple and is based on the Fourier shift property, which states that a shift in the coordinate frames of two functions is transformed tin the Fourier domain as linear phase differences. This can be described as follows,

Let $f_k(x,y)$ and $f_{k+1}(x,y)$ be two functions that are absolutely integrable over R^2. Let also

$$f_{k+1}(x,y) = f_k(x-d_1, y-d_2). \quad (1)$$

According to the Fourier shift property

$$\hat{f}_{k+1}(u,v) = \hat{f}_k(u,v)\exp\{-j2\pi(ud_1+vd_2)\}. \quad (2)$$

Hence the normalized cross power spectrum is given by

$$\frac{\hat{f}_{k+1}(u,v)\,\hat{f}_k^*(u,v)}{\left|\hat{f}_{k+1}(u,v)\,\hat{f}_k^*(u,v)\right|} = \exp\{-j2\pi(ud_1+vd_2)\} \quad (3)$$

Where * indicates the complex conjugate.

The normalized cross power spectrum may also be viewed as the cross power spectrum of whitened signals. There are two possible ways of solving (3) for (d_1, d_2). One way is to directly work in the Fourier domain. For this purpose, consider a three-dimensional (3-D) Euclidean space whose canonical reference frame is given by the two frequency axes and the phase difference between the two images. The second possible approach which is more practical and also more robust to noise is to first inverse Fourier transform the normalized cross power spectrum. It is then a simple matter to determine (d_1, d_2), since from (3) the result is $\delta(x-d_1, y-d_2)$ which a Dirac delta function is centered at (d_1, d_2), which corresponds to the displacement between the two images.

(a) (b) (c)

Figure 2 (a) and (b) Drawer images with displacements and (c) phase correlation.

5.2. Motion estimation

In each image frame of the sequence, four sub-images are designated as shown in Figure. These sub-images are used to determine local motion vectors using phase correlation. To enable FFT computation for phase correlation, sub-images are predetermined to be of square shape with horizontal and vertical pixel dimensions being a power of two. Typically a sub-image size of 32×32 is preferred to keep the computation load of motion estimation low and at the same time include sufficient spatial image content for correct estimation.

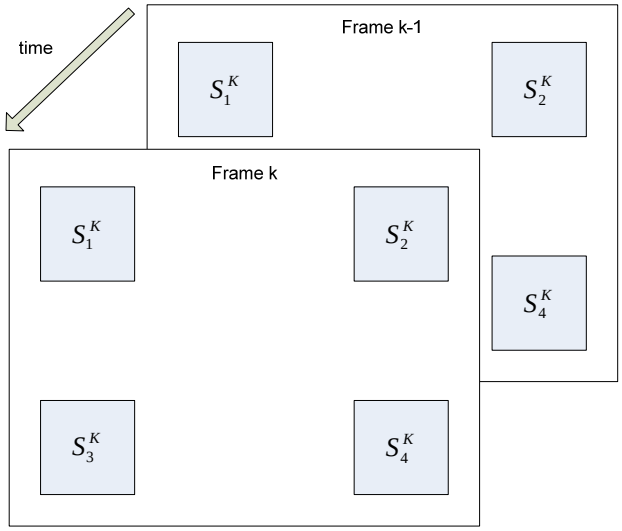


Figure 3 Location of sub-images used for local motion estimation.

For all four sub-images of an image frame, local motion vectors are estimated from the respective sub-images of the previous frame based on phase correlation. For each sub-image the largest peak amplitude location of the corresponding phase correlation surface is assigned as the local motion vector and recorded together with the corresponding peak amplitude value. For each image frame, in total four local motion vectors corresponding to the sub-images are estimated and the peak amplitude of each vector is noted. The global motion vector of the image frame can then be decided based on the peak amplitude values of local motion vectors.

The configuration of the DIS system is shown in Figure. The local motion estimation unit produces local motion vectors from subimage in the different position of the frame. The global motion decision unit determines the global motion vectors by processing

these local motion vectors and the previous global motion vectors, and the integration unit using the accumulated global motion vector decides whether the motion of a frame is caused by undesirable fluctuation of the camera or intentional panning. Finally, the stabilized image is generated by reading out the proper block of fluctuated image in the frame memory.

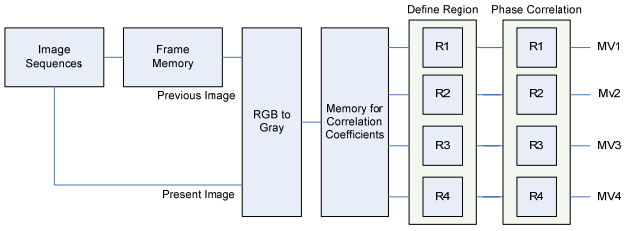


Figure 4 Block diagram of motion estimation system.

3. MOTION CORRECTION

In general, motion vectors from the subimage with moving objects are used in the present algorithms but it doesn't meet the proper need for the stabilization, preferably it should be excluded from the global motion decision process. Since the hand movement is relatively slower than the frame rate of the video camera, hence motion vectors of two successive frames fluctuated by camera's jitter should be similar. Based on these properties of camera's motion, we use a simple and robust motion correction scheme in which the global motion vector is determined by separately selecting the most maximum peak of each motion vector elements from subimage.

After determining the global motion vector, the motion correction system in Figure 5 decides whether camera's motion or intentional panning affects the motion of a frame.

An important point in motion correction is the distinction between jiggling and panning. Jiggling is the oscillatory movement that has to be stabilized. It hasn't a constant direction on consecutive frames and its amplitude is generally little. Panning is the wanted motion that user does to capture a wide area of the scene. It is directed in the same direction and displacements are bigger than jiggling. In [4] proposed distinction between jiggling and panning by threshold (T). If absolute of GMV is larger than T, panning occurs which is not correct .In the similar way ,even if absolute of GMV is smaller than T, jiggling starts and again it causes image to be destabilized. In this paper, we use AMV for panning [2]. The AMV computation procedure is given by

$$AMV[t] = kAMV[t-1] + \{\alpha FMV[t] + (1-\alpha)FMV[t-1]\}$$

Where t represents time index, the constant k, $0 < k < 1$, is used for smooth panning and for virtually enlarging the effective AMV range, and α, $0 \le \alpha \le 1$, for filtering out the unexpected noise effect on the AMV. Our proposed motion correction system in Figure 5.

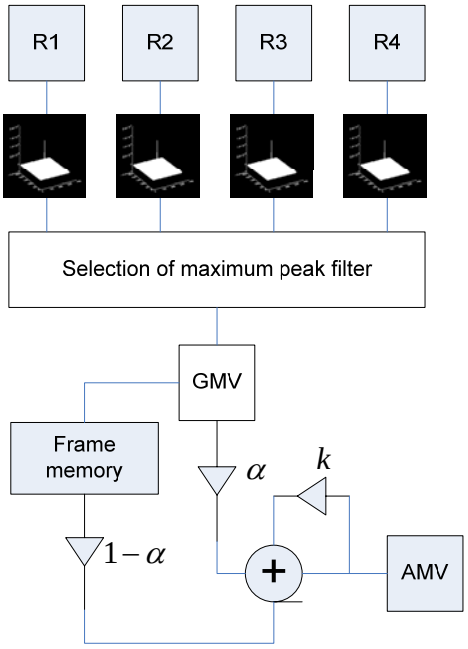


Figure 5 Block diagram of motion correction system.

4. EXPERIMENTAL RESULTS

In order to demonstrate the performance of the proposed algorithm, we used a single image frame from SONY Camcorder DCR-TRV900. We used a 640×480 image in outdoor and indoor. Block diagram for experiment is in Figure. We connect camcorder and computer by grabber from Meteor II standard. Color signal change to grey signal for motion estimation. After process motion estimation and motion correction we can get motion vector. Then we show original and stabilized image in real-time.

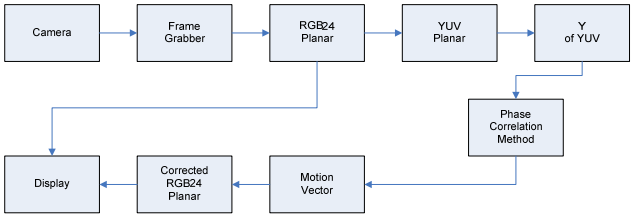


Figure 6. Block diagram of experimental process.

To show the performance of the proposed algorithm, Figure 7 show the original image and stable image in indoor and Figure 8 show the original image and stable image in outdoor.

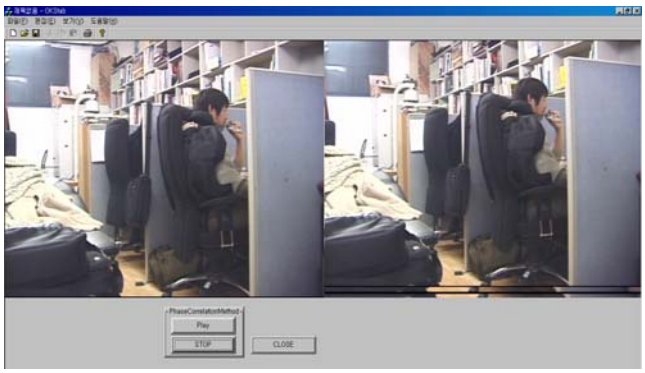


Figure 7 Experimental results in indoor.

Figure 8 Experimental results in outdoor.

5. CONCLUSIONS

In this paper, we proposed a digital image stabilization algorithm to remove unwanted displacement by hand shaking, which is based on subimage phase correlation for motion estimation and maximum peak filtering for motion correction. For simple and fast calculation, the input image is transformed into gray image and in order to obtain stabilized digital image, robust digital image stabilization algorithm along with AMV for automatic distinction and removing panning and jiggling have been used. In experimental results, we showed that the proposed stabilization algorithm could efficiently remove the unwanted displacement from the image with destructive consequences. In addition, the proposed digital image stabilization algorithms can be applied to the video surveillance system for face recognition and human tracking etc.

7. REFERENCES

[6] H. Foroosh, J.B. Zerubia and M. Berthod, "Extension of phase correlation to subpixel registration," *IEEE Trans. Image Processing*, vol. 11, pp. 188-200, 2002.

[4] Filippo Vella, Alfio Castorina, Massimo and Giuseppe Messina, "Digital image stabilization by adaptive block motion vectors filtering," *IEEE Trans. Consumer Electronics*, vol. 48, pp. 796-801, 2002.

[3] K. Uomori, A. Morimura, H. Ishii and Y. Kitamura, "Automatic image stabilization system by full-digital signal processing," *IEEE Trans. Consumer Electronics*, vol. 36, pp. 510-519, 1990.

[5] S. Erturk, "Digital Image Stabilization with Sub-Image Phase Correlation Based Global Motion Estimation," *IEEE Trans. Consumer Electronics*, vol. 49, pp. 1320-1325, 2003.

[2] J.K. Paik, Y.C. Park and D.W. Kim, "An adaptive motion decision system for digital image stabilizer based on edge pattern matching," *IEEE Trans. Consumer Electronics*, vol. 38, pp. 607-615, 1992.

[1] S.J. Ko, S.H. Lee, S.W. Jeon and E. S. Kang, "Fast digital image stabilizer based on gray-coded bit-plane matching," *IEEE Trans. Consumer Electronics*, vol. 45, pp. 598-603, 1999.

Manthan, International Journal, vol. 9, July, 2009, ISSN No. 0974-6331

Nucleic Acid Therapeutics

Pramod Yadava
Applied Molecular Biology Laboratory,
School of Life Sciences,
Jawaharlal Nehru University,
New Delhi 110067 INDIA

Information storage and retrieval, catalytic potential and self replicability are pivotal to qualify an autonomous biomolecule or biomolecular assembly, so much so that earliest living systems might have had nucleic acids as the main or sole constituent. It is not surprising that all expressions in living systems involve nucleic acids at the beginning as well as at the end of a series of steps along a biological pathway triggered by environmental or developmental cues.

Nucleic acids were discovered nearly 150 years ago by a Swiss Clinical Assistant Friederich Meischer as acidic constituent of nuclei of pus cells when the material basis of inheritance and the role of nuclear content in inheritance was not yet clear. Many conditions forming part of the environment in which Friedrich Meischer worked would have inspired him to attach extra importance to pus cell nuclear content. Some important basic lessons can be derived from a study of the then prevalent conditions in scientific laboratories for developing teaching and research programs today.

Friederich Meischer

Nucleic acids recognize their cognate molecules either by Watson-Crick rules for sequence complementarity or via higher order structures assumed by them. Thus nucleic acid markers can be found for most of the states of living systems including disease states. Many of these can be useful drug targets. Also since the nucleic acids-nucleic acid interactions are based on relatively simple rules of complementarity, nucleic acid drugs can be designed to modulate the form or abundance of the target molecules.

Disease can be viewed as a deviation of a living system from its normal physiological and biochemical equilibria characterizing its health or well being. This can often be attributed to change in the quality or quantity of a functional molecule. Alternatively it can be viewed as elevation of undesirable molecules and depletion of desirable molecules. Cause of this change may be either endogenous or may result from an environmental factor or an infectious agent. Any intervention that results in restoration of normal equilibria can be considered as therapy. Like any pair of mutually cognate molecules, a therapeutic molecule recognizes its target via geometric complementarity, charge compatibility, hydrophobicity, group to group interaction, hydrogen bonds, van der Waal's and other weaker interactions. Such molecules can be designed by first visualizing the detailed structure of the target itself and then testing molecules promising the best fitting with it. In many cases structure of molecules can be approximated by modeling for energy-miinimized conformations. As the size of a molecules increases, the number of variables that any such exercise has to take into account increases enormously and one inevitably deploys high power computing. In the absence of precise information on structure one can take a combinatorial approach where a pool of molecules such as would exist in the extract of natural cells and tissues is tested for the presence of any binders by essentially an affinity chromatographic approach. After a good number of target-binding molecules has been selected, those affecting the functionality of the target are screened and tested for

their therapeutic potential. However, if one could foresee binding as I the case of nucleic acid drugs for nucleic acid targets, one can directly harp on testing for therapeutic value of the designed nucleic acid drug. There are many reasons why one looks to nucleic acids as probable targets as well as drugs. Nucleic acids can be used in several forms as drugs e.g., (a) Nucleotide and base analogues, (b) Antisense oligonucleotides, (c) Triple helix-forming oligonucleotides, (d) Spieglemers, (e) Ribozymes, (f) Riboswitches, (g) interfering RNA e.g., siRNA, miRNA and shRNA and (h) RNA aptamers. The basis of target recognition in most cases results from complementarity of the sequence of bases in the target with those in the targeting molecule except for the nucleic acid aptamers which interact with nucleic acid or non-nucleic acid targets on the basis of higher order structure assumed by them. Taking into account the above, one can design a therapeutic nucleic acid molecule to prevent the template function of the target nucleic acids with reference to their replication, transcription, post-transcriptional processing or translation. One can make necessary modifications in the therapeutic molecule to achieve the desired pharmacokinetic properties such as water solubility, half life in the system, specificity, and no or minimal off target effects.

Catalytic RNA can be used to cleave the target molecules or to trans-splice a wild type (normal) sequence of RNA into a mutant RNA thereby correcting the latter. Sometimes a non-nucleic acid regulatory factor for gene expression can be sequestered with the help of nucleic acids assuming a cognate structure. In our research group we are constructing targeted ribozymes against targets like tumor necrosis factor alpha (a drug target for auto-immune disorders like diabetes mellitus or rheumatoid arthritis), and telomerase (a drug target for a majority of cancer types). We are also constructing RNA aptamers binding with chosen ligands known to be of significance in certain disease e.g., calcium and glutathione. We are also trying to develop modified measles viruses that would recognize the affected cells and deliver therapeutic RNA to them. Many antisense oligonucleotides and ribozymes constructed by other research groups are in various phases of clinical trials. The advantages with nucleic acid therapeutics are (a) very high specificity, (b) minimal off-target effect, and (c) possibility of direct or vector-mediated delivery etc. On the other hand the smallest of these molecules will be several thousand Daltons by molecular mass so that it takes a lot more mass as compared to small molecule drugs in order to attain comparable molar abundance. Strident progress is also being made in developing targeted delivery vehicles which partly compensates for the large mass requirement.

Human Development- necessity of grassroots approach

Indra R. Sharma
New Delhi, India

Human development is a basic necessity, and need not be only through formal education system. If I look back down the memory lane, I find many instances of informal human development.

In my village, I had come across an old man with hardly any education, but whenever he talked about the finer points of Ramcharitmanas, he was an authority and I have not found anyone like him till date. In my college, some teachers with much lesser qualifications stunned me and many.

During my professional career, I found dozens who were almost like Viswakarma so far the mechanical trouble-shootings were concerned. I remember Naidu, Patra, PC Sharma or TP Ghosh to name a few, who could translate any new idea that I wanted to get implemented into machining operations. In every areas of automobile manufacturing that I was concerned with, I found great brains. I used some to get trained newcomers. But the formal system hardly recognizes this potential. I kept on working hard and going up the ladder, but kept the educating my subordinate as one of the prime interests. I used to write troubleshooting checklists on different machining processes and circulate among the subordinates. And that was my way of developing the people. Ultimately, it got published as book through Tata McGraw-Hill, New Delhi.

Unfortunately, the system doesn't allow and encourage the real skilled persons in industry or in the social groups to train new recruits or the unskilled one that are in plenty all around. The country such as India needs skilled hands in millions that can go straight to work in housing industry, or many other service and manufacturing sector. However, it is difficult to find employable young men and women who can straight be put to work.

The country produces near million commercial vehicle including heavy, and light such as autos. Passenger cars are additional. The country needs at least a million drivers. Are we having sufficient number of institutes to cater to this requirement? Unfortunately, what we see in form of cars displaying the name of the driving schools in every locality of the country hardly does a right job of training. And have you tested any of those new drivers yourselves? If you employ one, you can see him learning driving at your cost after damaging the car. The country requires huge number of motor mechanics, electricians, plumbers, and masons. And the country hardly does have the facilities. Let the best of the skilled hands be used as trainers as an additional responsibility and with extra remuneration or allow them to do that as profession with some fee. Let there be many independent but honest certifying agencies to issue the certificate of skill after proper examination and practical tests so that the successful ones can join the job straight in a day or two with productivity level of the average older employees.

Many of us would have read about Lalmuni Devi, the woman who started growing mushrooms in her shanty or Anita Kushwaha, the bee-keeping girl. Why were not these entrepreneurs used to train many more like them to get them out from the curse of poverty? Perhaps it is because of the mindset of those who wish to perpetuate the poverty of such persons for vested interest. Let me confess even after completing mechanical engineering from IIT, Kharagpur, the best of the time, I was hardly of any worth to the company. I took years to learn my lob, as I wanted that. I did contribute on every machine that came under my jurisdiction. But I have seen many who get retired without learning anything of engineering. Those days have gone and today with heavy competition the employer can't afford to spend so much of time and resources on new employees. Specializations have increased. Employers seek ready stuff.

It certainly means that the level of interactions between the academic curricula and industry are hardly proactive to take care of the gap. The education needs reengineering. The sector requires innovative leaders and full autonomy with accountability. Here too a ranking by some regulatory authority may be essential with tremendously growing crops of the private institutes.

Industrial enterprises have also failed in shouldering this responsibility. Infosys boasts of making 20,000-Rupee millionaires, but why should not it come out with data on furthering education levels of its employees? How many of its employees who entered as ordinary science graduates could get qualified as graduate software engineers or computer scientists with Master or PH.D while working in the company? How many of office assistants could get qualified as cost accountant or chartered accountants? How many of the employees could be encouraged to hold some patents? How many of its employees could become entrepreneurs because of the encouragement from the

company? I wish if even the 100 top companies of the country take up the mission to developing the human resources with right earnestness, the economic scenario in the country will change considerably for innovation and entrepreneurship.

As I knew from nearer quarters both TELCO (present Tata Motors) and to a smaller extent Hindustan Motors had set up good training scheme with facilities for various trades. Unfortunately, over the period the importance of the training got diluted. In HM, the management and the union, both were the killers of a scheme that could have provided constant flow of already trained workforce.

Even the educational institutes fail in pursuing this task of human development. Why an institution can't transform its teachers and even its ordinary employees into best educated talents? I wish even IITs could have taken initiatives to upgrade the teaching skills of its teachers. At least in my time, there were just few teachers who could command respect for their knowledge or for the content they taught.

Let us agree that the formal education must demolish its set pattern and innovate to work differently to meet the requirements of the society that it serves.

Manthan, International Journal, Vol. 9, July, 2009, ISSN No. 0974-6331

Nano-Medicine and Drug Development

Mohammad Abul Farah
Research Center for Proteineous Materials
Chosun University
Gwangju, South Korea
farahkorea@yahoo.com

Nanomedicine is the medical application of nanotechnology. The approaches to nanomedicine range from the medical use of nanomaterials, to nanoelectronic biosensors, and even possible future applications of molecular nanotechnology. Current problems for nanomedicine involve understanding the issues related to toxicity and environmental impact of nanoscale materials. Nanomedicine research is directly funded, with the US National Institutes of Health in 2005 funding a five-year plan to set up four nanomedicine centers. In April 2006, the journal Nature Materials estimated that 130 nanotech-based drugs and delivery systems were being developed worldwide.

Overview

Nanomedicine seeks to deliver a valuable set of research tools and clinically helpful devices in the near future. The National Nanotechnology Initiative expects new commercial applications in the pharmaceutical industry that may include advanced drug delivery systems, new therapies, and in vivo imaging. Neuro-electronic interfaces and other nanoelectronics-based sensors are another active goal of research. Further down the line, the speculative field of molecular nanotechnology believes that cell repair machines could revolutionize medicine and the medical field.

Nanomedicine is a large industry, with nanomedicine sales reaching 6.8 billion dollars in 2004, and with over 200 companies and 38 products worldwide, a minimum of 3.8 billion dollars in nanotechnology R&D is being invested every year. As the nanomedicine industry continues to grow, it is expected have a significant impact on the economy.

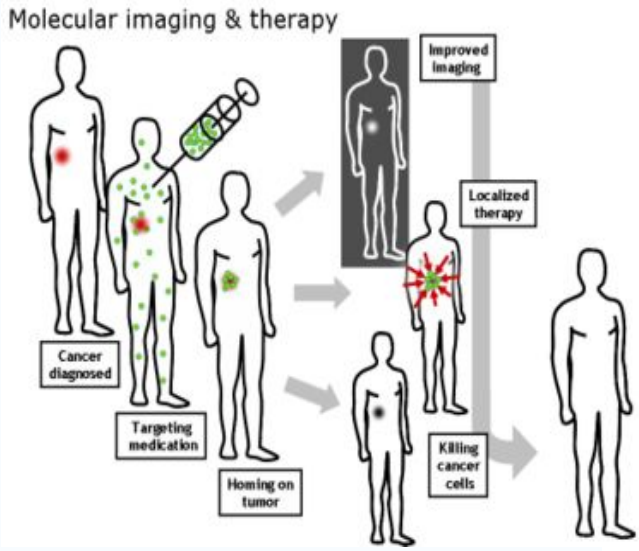
Medical use of nanomaterials

Drug delivery

Nanomedical approaches to drug delivery center on developing nanoscale particles or molecules to improve the bioavailability of a drug. Bioavailability refers to the presence of drug molecules where they are needed in the body and where they will do the most good. Drug delivery focuses on maximizing bioavailability both at specific places in the body and over a period of time. This will be achieved by molecular targeting by nanoengineered devices. It is all about targeting the molecules and delivering drugs with cell precision. Over 65 billion dollars is wasted every year because of poor bioavailability. *In vivo* imaging is another area where tools and devices are being developed. Using nanoparticle contrast agents, images such as ultrasound and MRI have a favorable distribution and improved contrast. The new methods of nanoengineered materials that are being developed might be effective in treating illnesses and diseases such as cancer. What nanoscientists will be able to achieve in future is beyond current imagination. This will be accomplished by self assembled biocompatible nanodevices that will detect, evaluate, treat and report to the clinical doctor automatically.

Drug delivery systems, lipid- or polymer-based nanoparticles, can be designed to improve the pharmacological and therapeutic properties of drugs. The strength of drug delivery systems is their ability to alter the pharmacokinetics and biodistribution of the drug. Nanoparticles have unusual properties that can be used to improve drug delivery. Where larger particles would have been cleared from the body, cells take up these nanoparticles because of their size. Complex drug delivery mechanisms are being developed, including the ability to get drugs through cell membranes and into cell cytoplasm. Efficiency is important because many diseases depend upon processes within the cell and can only be impeded by drugs that make their way into the cell. Triggered response is one way for drug molecules to be used more efficiently. Drugs are placed in the body and only activate on encountering a particular signal. For example, a drug with poor solubility will be replaced by a drug delivery system where both hydrophilic and hydrophobic environments exist, improving the solubility. Also, a drug may cause tissue damage, but with drug delivery, regulated drug release can eliminate the problem. If a drug is cleared too quickly from the body, this could force a patient to use high doses, but with drug delivery systems clearance can be reduced by altering the pharmacokinetics of the drug. Poor biodistribution is a problem that can affect normal tissues through widespread distribution, but the particulates from drug delivery systems lower the volume of distribution and reduce the effect on non-target tissue. Potential nanodrugs will work by very specific and well-

understood mechanisms, one of the major impacts of nanotechnology and nanoscience will be in leading development of completely new drugs with more useful behavior and less side effects.



A schematic illustration showing how nanoparticles or other cancer drugs might be used to treat cancer.

Caner

Nanoparticles of cadmium selenide (quantum dots) glow when exposed to ultraviolet light. When injected, they seep into cancer tumors. The surgeon can see the glowing tumor, and use it as a guide for more accurate tumor removal. Sensor test chips containing thousands of nanowires, able to detect proteins and other biomarkers left behind by cancer cells, could enable the detection and diagnosis of cancer in the early stages from a few drops of a patient's blood.

Researchers at Rice University under Prof. Jennifer West, have demonstrated the use of 120 nm diameter nanoshells coated with gold to kill cancer tumors in mice. The nanoshells can be targeted to bond to cancerous cells by conjugating antibodies or peptides to the nanoshell surface. By irradiating the area of the tumor with an infrared laser, which passes through flesh without heating it, the gold is heated sufficiently to cause death to the cancer cells.

One scientist, University of Michigan's James Baker, believes he has discovered a highly efficient and successful way of delivering cancer-treatment drugs that is less harmful to the surrounding body. Baker has developed a nanotechnology that can locate and then eliminate cancerous cells. He looks at a molecule called a dendrimer. This molecule has over a hundred hooks on it that allow it to attach to cells in the body for a variety of purposes. Baker then attaches folic-acid to a few of the hooks (folic-acid, being a vitamin, is received by cells in the body). Cancer cells have more vitamin receptors than normal cells, so Baker's vitamin-laden dendrimer will be absorbed by the cancer cell. To the rest of the hooks on the dendrimer, Baker places anti-cancer drugs that will be absorbed with the dendrimer into the cancer cell, thereby delivering the cancer drug to the cancer cell and nowhere else.

In photodynamic therapy, a particle is placed within the body and is illuminated with light from the outside. The light gets absorbed by the particle and if the particle is metal, energy from the light will heat the particle and surrounding tissue. Light may also be used to produce high energy oxygen molecules which will chemically react with and destroy most organic molecules that are next to them (like tumors). This therapy is appealing for many reasons. It does not leave a "toxic trail" of reactive molecules throughout the body (chemotherapy) because it is directed where only the light is shined and the particles exist. Photodynamic therapy has potential for a noninvasive procedure for dealing with diseases, growths, and tumors.

Surgery

At Rice University, a flesh welder is used to fuse two pieces of chicken meat into a single piece. The two pieces of chicken are placed together touching. A greenish liquid containing gold-coated nanoshells is dribbled along the seam. An infrared laser is traced along the seam, causing the two sides to weld together. This could solve the difficulties and blood leaks caused when the surgeon tries to restitch the arteries he/she has cut during a kidney or heart transplant. The flesh welder could meld the artery into a perfect seal.

Visualization

Tracking movement can help determine how well drugs are being distributed or how substances are metabolized. It is difficult to track a small group of cells throughout the body so scientists used to dye the cells. These dyes needed to be excited by light of a certain wavelength in order for them to light up. While different color dyes absorb different frequencies of light, there was a need for as many light sources as cells. A way around this problem is with luminescent tags. These tags are quantum dots attached to proteins that penetrate cell walls. The dots can be random in size, can be made of bio-inert material, and they demonstrate the nanoscale property that color is size-dependent. As a result, sizes are selected so that the frequency of light used to make a group of quantum dots fluoresce is an even multiple of the frequency required to make another group incandesce. Then both groups can be lit with a single light source.

Manthan, International Journal, Vol. 9, July, 2009, ISSN No. 0974-6331

The Genes For Cancer

Jawaid Ahmad
Research Scientist, Bio-Solution
Hyderabad, India
Ja_res@rediffmail.com

CANCER

Cell division is a normal process in multicellular organisms. Growth an repair take place as a result of mitotic cell division. Except for cells like the lever and brain cells which rarely divide in the mature adult. Some times, however, cell division becomes very rapid and uncontrolled, leading to cancer. Cells which undergo rapid, abnormal and uncontrolled growth at the cost of remaining cells are called neoplastics cells. The growths resulting from the division of such cells are called neoplastics growths or tumours. Tumours are commonly classified as benign and malignant. Abnormal and persistent cell division that remains localized at the spot of origin results in the so called benign tumours eg. Brain Tumours. Tumour cells may be carried by the blood stream, or the lymphatic system or by direct penetration to the other parts of the body. Where they may induce secondary tumours. Such invasive cancers ultimately result in the death of the organism and are therefore, said to be malignant. Cancer cells are characterized by many distinctive properties; altered morphology, loss of contact, inhibition, high sugar uptake, increased anaerobic glycolysis, altered surface topology and changed immunological behaviour. It is this change which relives the cell of the normal constrance on cellural growth and leads to uncontrolled cell division and prolifilaration in a response to its own imperative, rather than in response to the external stimuli, generally required for cellular growth. Global cancer research in recent year is focused on identifying and characterizing the molecular parameters responsible for this fundamental change of the cell. Now we know that certain specific genes, cancer-genes, are responsible for fundamental change of the cell. These cancer genes, more appropriately called oncogenes (from onbos, the greek words formas or tumour), are the real driving force behind uncontrolled growth of many cancer cells. Oncogenes are found in all the cells of our body ,accept mammalian red blood cells which lack nuclei, but the vast majority of cells never become cancerous because they never get activated. In other words, our own cell contains genes with the potential to cause cancerous transformations.

THE DISCOVERY

The story of oncogenes dates back as early as 1911 when Francis Papyton Rous discovered a virus which causes Sarcoma in chickens. This was followed by isolation of numerous cancer-causing viruses from various types of tumours. These cancer-causing viruses are known as “Retroviruses” because there genetic material is not DNA but RNA which is copied into DNA by enzyme reverse transcriptace. Around mid – 1970’s several groups have shown the presence of a single cancer-causing gene in the viral genome.
In 1978, Chiaho Shih of Massachusetts Institute of Technology, USA, demonstrated the transmission of cancer traits from one mammalian cells to another by transfer of DNA molecules from cancer cell. Cells transformed by transfer of DNA molecules exhibit various characteristics of those tumours which are induced by tumour – virus infection and developed tumours on inoculation into mice, transfer of DNA molecules from normal cells had no such tumour-producing effect. These experiments indicated a difference the DNA sequences of the tumour cells and that of normal cells which was responsible for the cancerous behaviour of recipient cells. Similar results where obtained in case of DNA from various other types of tumours such as carcinomas of the bladder, colone and lung, fibrosarcomas, neuroblastoma and leukemias. Having established the genetic basis of cancer, next important was to characterize the transforming segment of DNA. The classical experiments of serial transfer of DNA through various cycles of gene resided in a single DNA segments which was not lost during repeated extraction and coprecipitation steps. With the advent of gene cloning. Three different groups ,namely, Geoffrey M.copper at Dana Farber Cancer Institute, USA and Michal Wiglers at Coldspring Harber Laboratory, USA simultaneously isolated a single transforming DNA segment of potent biological activity. It was an oncogene, a cancer gene.

ORIGIN OF ONCOGENE

Oncogene is a slightly altered version of the normal gene which is also called a proto-oncogene. Oncogenes are almost identical to each other but each functions

quite different from one another. Clones of oncogenes can transform the cells where those of proto-oncogenes cannot. Inclusion of proto-oncogenes in the genome indicates there possible role in normal cellular metabolism. They are proto-oncogenes and there viral acquisition is believed to have occurred due to recombinational events between the genome of the infecting retrovirus and that of the host cells. These viruses in turn transformed the infecting cells. DNA sequences of many viral oncogenes have been identified and it has been found that the DNA sequences homologous to the transforming genes of certain retroviruses have been found in normal untransformed cells. DNA sequences homologus to the transforming genes of virus oncogenes have identified in a variety of normal uninfected cells including those of man. These cellular counterparts of viral oncogenes are known as cellular oncogenes. Tracing the evolution one find that structure of cellular oncogenes is conserved through out the evolutionary history because it is found in species as diverse as fruit-flies, fish, mammals including humans and even in yeast. The close conservation of cellular gene probably reflects its essential role in critical physiological functions in cell differentiation or in the regulation of cell division. The question then is what makes the gene go wrong and produced the uncontrolled cell division seen in cancer cells?

Activation of oncogenes

What are those factors which activate proto-oncogenes to become oncogenic and produce uncontrolled cell division and abnormal differentiation patterns seen in cancer cells? Some of the possible answers are increased production of gene product in the life of the cell which in turn makes cell cancerous. Large amounts of viral gene products have been shown to be made in infected cells.broadly,there are three different molecular mechanisms of activation :

1. Point mutation- Application of genetic engineering has made it possible to narrow down the region of interest from the whole gene to a relatively small fragment. In the case of human bladder carcinoma gene, transforming activity is shown to be restricted to a segment of 350 nucleotides only. Sequence analysis by Ravi Dhar of National cancer institute,USA suggests that only one base , a guanine in the proto-oncogene is replaced by a thymine base in the oncogene of bladder carcinoma genes. Thus a single nucleotide, a " point mutation " in a 5000 nucleotide of normal human gene could convert it into an oncogene; mutation of a proto-oncogene may be a critical event in the initiation of many cancers.

2. Chromosomal rearrangement: L.C.Grace and Michal D. Ccle, USA, discovered that chromosomal rearrangement is one of the possible mechanisms of proto-oncogene activation in some types of cancer.

3. Amplification: In some cancer cells there are many extra copies of a particular proto-oncogene instead of the normal two copies characteristic of most cellular genes. This oncogene amplification and in turn increased oncogene expression may also play an important role in the development of cancer by excess production of gene product. Amplification of gene is possible one of the initial steps by which cells become cancerous or it may atleast contribute to yhe progression of cancer to a more malignant form. In that case of mammalian tumor gene, all these three mechanisms may be at work. In the case of retrovirus-associated genes the transduced gene may undergo mutation or may end up adjacent to regulator unit of the gene which ultimately increases its level of expression thus activation of proto-oncogene might be involved in the etiology of the cancer in general, not just those involving viruses.

Action

Not much is known about the function of oncogene.Like other genes it also encodes the structure of a protein. Each amino acid of a protein is coded by a three base codon in the gene which encodes the protein structure. Point mutation observed in the case of bladder carcinoma oncogene can alter the structure of the protein because GCG base codon of proto- oncogene codes for glycine amino acid while GTC codon of oncogene for valine. Thus single amino acid substitution in the protein may some times cause proteins to acquire novel functions of abnormal cellular metabolism. Oncogene seems to regulate cancerous growth in the same manner as encoded by proto- oncogenes that control normal growth.

Significance

A clear cut understanding of the functions of oncogene proteins is very important before one could think of developing antagonists that inhibit a particular function to develop a cancer therapy. In recent years evidences have begun to accumulate that till in favour of a multistep independently controlled process in the tumor formation the creation of an oncogene fulfils only one basic requirement for making the cell cancerous. A number of other necessary steps are required for cancerous transformation. These steps may or may not be inter-dependent. Scientists all over the world are hopeful of solving the problem of oncogene products, sequencing the gene and thus finding out the ultimate functions of these oncogenes. All these things will ultimately prove to be useful in manipulating the fundamental genetic changes that cause cancer in human body

Manthan, International Journal, Vol. 9, July, 2009, ISSN No. 0974-6331

Manthan

Basics of Radiocarbon Dating

Kumud Kumari and Brajesh Kumar
Patna, India

The term "radiocarbon" is commonly used to denote ^{14}C, an isotope of carbon which is radioactive with a half-life of about 5730 years. ^{14}C is produced by cosmic rays in the stratosphere and upper troposphere. It is then distributed throughout the rest of the troposphere, the oceans, and Earth's other exchangeable carbon reservoirs. In the surface atmosphere, about one part per trillion (ppt) of carbon is ^{14}C.

All organisms absorb carbon from their environment. Those that absorb their carbon directly or indirectly from the surface atmosphere have about 1 ppt of their carbon content as ^{14}C. Such organisms comprise almost all land dwelling plants and animals. (Other organisms—e.g. fish—have slightly less of their carbon as ^{14}C; this affects how radiocarbon dating works, and there are methods of adjusting for it.) When an organism dies, carbon stops being absorbed. Hence after 5730 years, about half of its ^{14}C will have radioactively decayed (to nitrogen): only about 0.5 ppt of the carbon of the organism's remains will be ^{14}C. And if the carbon of the remains is found to be 0.25 ppt ^{14}C, then the organism would be assumed to have died about 11 460 years ago. Thus, a simple calculation can find the age, since death, from any ^{14}C concentration. (Remains older than about 50 000 years, however, have a ^{14}C concentration that is in practice too small to measure; so they cannot be dated via ^{14}C.) Ages are conventionally reported together with the standard deviation of the laboratory ^{14}C measurement, e.g. 900±25 ^{14}C BP (^{14}C -dated, years Before Present). This should be doubled to obtain a 95%-confidence interval, e.g. 850–950 14C BP. (The true range of 95%-confidence, though, will often be larger than this, due to non laboratory sources of error—e.g. the admixture of impurities with the remains.) Although a tree may live for hundreds, even thousands, of years, each ring of a tree absorbs carbon only during the year in which it grows. The year in which a ring was grown can be determined exactly (by counting); so radiocarbon dating can be tested by measuring the ^{14}C concentrations in old tree rings. Such testing found errors of up to several centuries. It turns out that the concentration of ^{14}C in the surface atmosphere has not been a constant 1 ppt, but has varied with time. Thus the simple calculation of age from ^{14}C concentration is unreliable. Tree rings, though, also provide a solution to this problem. The concentration of ^{14}C in an organism's remains can be compared with the concentrations in tree rings; the tree rings that match, within confidence limits, give the years in which the organism could have plausibly died. Ages determined this way are called "calibrated ^{14}C ages"; others are called "uncalibrated ^{14}C ages", or simply "^{14}C ages", and continue to be reported as "^{14}C BP". (Calibration via tree rings, though, does not extend for 50000 years, only several thousand. Other ways of calibrating are therefore being developed.) Calibrated ^{14}C ages are generally greater than uncalibrated ^{14}C ages, with the differences increasing with age.

How was radiocarbon dating developed?

The radiocarbon method was developed by a team of scientists led by the late Professor Willard F. Libby of the University of Chicago after the end of World War 2.
Libby later received the Nobel Prize in Chemistry in 1960 for the radiocarbon discovery. Today, there are over 130 radiocarbon dating laboratories around the world producing radiocarbon dates for the scientific community. The C14 method has been and continues to be applied and used in many, many different fields including hydrology, atmospheric science, oceanography, geology, palaeoclimatology, archaeology and biomedicine.

How does radiocarbon dating work?

All plants and animals on Earth are made principally of carbon. During the period of a plant's life, the plant is taking in carbon dioxide through photosynthesis, which is how the plant makes energy and grows. Animals eat plants, and some eat other animals in the food chain. Carbon follows this pathway through the food chain on Earth so that all living things are using carbon, building their bodies until they die.

A tiny part of the carbon on the Earth is called Carbon-14 (C14), or radiocarbon. It is called 'radio'-carbon, because it is 'radioactive'. This means that its atomic structure is not stable and there is an uneasy relationship between the particles in the nucleus of the

atom itself. Eventually, a particle is emitted from the carbon 14 atom, and carbon 14 disappears. Most of the carbon on Earth exists in a slightly different atomic form, although it is chemically speaking, identical to all carbon.

In the 1940s, scientists succeeded in finding out how long it takes for radiocarbon to disappear, or decay, from a sample of carbon from a dead plant or animal. Willard Libby, the principal scientist, had worked in the team making the nuclear bomb during World War 2, so he was an expert in nuclear and atomic chemistry. After the war he became very interested in peaceful applications of atomic science. He and two students first measured the "half-life" of radiocarbon. The half-life refers to the amount of time it takes for half the radiocarbon in a sample of bone or shell or any carbon sample to disappear. Libby found that it took 5568 years for half the radiocarbon to decay. After twice that time (about 11000 years), another half of that remaining amount will have disappeared. After another 5568 years, again another half will have disappeared. You can work out that after about 50 000 years of time, all the radiocarbon will have gone. Therefore, radiocarbon dating is not able to date anything older than 60 or 70 000 years old. The job of a radiocarbon laboratory is to measure the remaining amounts of radiocarbon in a carbon sample. This is very difficult and requires a lot of careful work to produce reliable dates.

What kind of things can you date using radiocarbon?

Because carbon is very common on Earth, there are alot of different types of material which can be dated by scientists. Below is a list of the different kinds of materials which can be dated:

- Charcoal, wood, twigs and seeds.
- Bone.
- Marine, estuarine and riverine shell.
- Leather.
- Peat
- Coprolites (samples of preserved faeces).
- Lake muds (gyttja) and sediments.
- Soil.
- Ice cores.
- Pollen.
- Hair.
- Pottery.
- Metal casting ores.
- Wall paintings and rock art works.
- Iron and meteorites.
- Bird eggshell.
- Corals and foraminifera.
- Blood residues.
- Textiles and fabrics.
- Paper and parchment.
- Fish remains.
- Insect remains.
- Resins and glues.
- Antler and horn.
- Water.

Uranium-Uranium Dating

Kumud Kumari and Brajesh Kumar
Patna, India

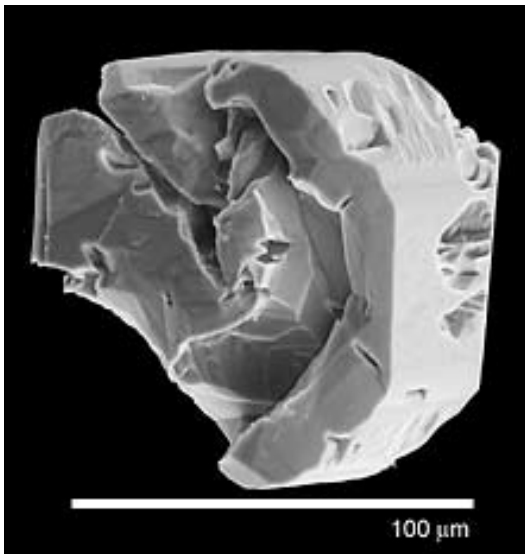
Uranium-uranium dating is a radiometric dating technique utilizing the comparison of two isotopes of uranium (U) in a sample: ^{234}U and ^{238}U. $^{234}U/^{238}U$ dating is one of several radiometric dating techniques exploiting the uranium radioactive decay series, in which ^{238}U undergoes 14 alpha and beta decay events while decaying to the stable isotope ^{206}Pb. Other dating techniques using this decay series include uranium-thorium (using $^{230}Th/^{238}U$) and uranium-lead dating.

^{238}U, with a half-life of about 4.5 billion years, decays to ^{234}U through emission of an alpha particle to an isotope of thorium (^{234}Th), which is comparatively unstable with a half-life of just 24 days. ^{234}Th then decays through beta particle emission to an isotope of protactinium, ^{234}Pa. ^{234}Pa decays with a half-life of 6.7 hours, again through emission of a beta particle, to ^{234}U. This isotope has a half-life of about 245,000 years. The next decay product, ^{230}Th, has a half-life of about 75,000 years and is used for the related $^{230}Th/^{238}U$ technique. Although analytically simpler than $^{230}Th/^{238}U$ dating, in practice $^{234}U/^{238}U$ dating is almost never used as unlike $^{230}Th/^{238}U$ dating it requires prior knowledge of the $^{234}U/^{238}U$ ratio at the time the material under study was formed. For those materials (principally marine carbonates) for which the initial ratio is known, $^{230}Th/^{238}U$ remains a superior technique. This restricts the application of $^{234}U/^{238}U$ to extremely rare cases where the initial $^{234}U/^{238}U$ is well-constrained and the sample is also beyond the ca. 450,000 year upper limit of the $^{230}Th/^{238}U$ technique.

Unlike other radiometric dating techniques, those using the uranium decay series (except for those using the stable final isotopes ^{206}Pb and ^{207}Pb) compare the ratios of two radioactive unstable isotopes. This complicates calculations as both the parent and daughter isotopes decay over time into other isotopes.

In theory, the $^{234}U/^{238}U$ technique can be useful in dating samples between about 10,000 and 2 million years Before Present (BP), or up to about eight times the half-life of ^{234}U. As such, it provides a useful bridge in radiometric dating techniques between the ranges of $^{230}Th/^{238}U$ (accurate up to ca. 450,000 years) and U-Pb dating (accurate up to the age of the solar system, but problematic on samples younger than about 2 million years).

URANIUM/LEAD DATING PROVIDES MOST ACCURATE DATE YET FOR EARTH'S LARGEST EXTINCTION



A new study by geologists at the Berkeley Geochronology Center and the University of California, Berkeley, improves upon a widely used dating technique, opening the possibility of a vastly more accurate time scale for major geologic events in Earth's history.

In a paper published this week in Science, geochemist Roland Mundil of the Berkeley Geochronology Center (BGC) and his colleagues at BGC and UC Berkeley report that uranium/lead (U/Pb) dating can be extremely accurate - to within 250,000 years - but only if the zircons from volcanic ash used in the analysis are specially treated. To date, zircons - known to many as a semiprecious stone and December's birthstone - have often produced confusing and inaccurate results.

Zircons have produced complicated data that are hard to interpret, though people have pulled dates out,"said Mundil, a former UC Berkeley postdoctoral fellow now at the BGC, a non-profit scientific research

institute dedicated to perfecting dating techniques for establishing the history of Earth and life on Earth.
"Many of these studies will now have to be redone."
The U/Pb isotopic dating technique has been critical in dating geologic events more than 100 million years old, including volcanic eruptions, continental movements and mass extinctions.

"The beauty of this new technique is that we now can analyze samples we previously could not get an accurate date for," Mundil said. "This will have a big impact on radio-isotopic dating in general."

Mundil and his colleagues, including BGC director Paul Renne, adjunct professor of earth and planetary science at UC Berkeley, used this improved U/Pb technique to establish a more accurate date for the end of the Permian period and the beginning of the Triassic period - 252.6 million years ago, plus or minus 200,000 years. This boundary coincides with the largest extinction of life on Earth, when most marine invertebrates died out, including the well-known flat, segmented trilobites.

Based on the improved U/Pb technique, the team also established that the argon/argon (Ar/Ar) isotopic dating technique that Renne employed for an earlier study of the Permian-Triassic boundary consistently gives younger dates, by about 1 percent. Renne ascribes this to a lack of a precise measurement of the decay constant of potassium. The technique is based on the fact that the naturally occurring isotope potassium-40 decays to argon-40 with a 1.25 billion year half-life. Comparison of the amount of argon-39 Produced in a nuclear reactor to the amount of argon-40 gives a measure of the age of the rocks.

Uranium, on the other hand, is so well studied that its decay constant is much better known, making the U/Pb dating technique more accurate, Mundil noted. U/Pb dating relies upon the decay of naturally occurring uranium and different isotopes of lead.

"Further application of Mundil's approach will make the geologic time scale more accurate, letting us calibrate extinctions and important events in Earth's history, ranging from 100 million to several billion years ago, with unparalleled accuracy," Renne added.
The new U/Pb date, though about 2.5 million years older than Renne reported nine years ago based on Ar/Ar dating, nevertheless confirms his conclusion that the Permian extinction occurred at the same time as a major series of volcanic eruptions in Siberia. This is strong evidence that these eruptions caused, at least in part, the global die-off, which some scientists have ascribed to a meteor impact.

Mundil noted that in 1998, one group used U/Pb dating to assign a date of 251.4 million years ago for the main pulse of the Permina extinction, in apparent conflict with the new U/Pb age. That 'age,' however, "is based on interpretation of a very complicated data set," Mundil said.

Mundil and his colleagues set out to resolve the issue, using a new zircon pretreatment invented by UC Santa Barbara isotope geologist James M. Mattinson. The problem with using microscopic zircons, which are prevalent in volcanic ash, is that the decay of uranium to lead is so energetic that the lead atoms smash through and destroy the zircon crystal structure, which apparently allows some lead to leak out of the crystal, throwing off the analysis. Geologists have tried various zircon treatments, including abrading the outer surfaces of the crystals, which are typically a tenth of a millimeter across, or leaching the crystals with strong acid. Despite these treatments, the U/Pb method still produced a wide range of dates for zircons from the same layer of ash.

Mattinson's idea was to first heat or anneal the zircons, sealing off the least damaged areas of the crystal, then using a strong reagent, hydrofluoric acid, to eat away the heavily damaged areas.
When Mundil used this treatment, the zircon dates were much more consistent, requiring no selective interpretation of the data. The calculated uncertainty is about a quarter of a million years, which means the extinction took place over a very short time, the researchers concluded.

The zircons were obtained from ash layers located in central and southeastern China. The Meishan section in the latter region is accepted as the type locality for the Permian/Triassic boundary.

- Whereas the U/Pb method yields ages which are more accurate, "Ar/Ar is still king in dating rocks younger than 100 million years and is about as precise as U/Pb methods, though we need to get better data for the decay constants to establish an absolute calibration," Renne said. "As soon as that calibration is put in place, the Ar/Ar method could become as accurate as U/Pb."

Manthan, International Journal, Vol. 9, July, 2009, ISSN No. 0974-6331

Manthan

Do We Have Enough Forests ? A Review of Conventional Wisdom

Kumkum Sinha [a] ***and Sudha Upadhyay*** [b]

[a]*Department of Physics, Ranchi Women's College, Ranchi University, Ranchi*

[b]*Department of Chemistry, Ranchi Women's College, Ranchi University, Ranchi*

ABSTRACT

Considering the pivotal role of forests in global sustainability practices, conservation of forests has gained immense importance in today's world. Its potentiality towards acquiring sustainability is immense. A large number of our village dwellers residing in the vicinity of forests are still dependent somehow or other on the forests for their livelihood. The gradually diminishing flora and fauna, on the verge of extinction, can not be overlooked and need special care as they are an integral part of our global environment. On one hand efficient forest management can fulfill to a great extent the growing global demand for renewable bio resources ---- feedstock of biotechnology and at the same time, it is indispensable for the mitigation of ever increasing environmental problems. So, it becomes pertinent to implement multifaceted strategies of conservation for sustainable development.

Keywords: Global sustainability practices, Conservation of forests, Environmental problems, Flora and fauna.

INTRODUCTION

Forests are nature's most bountiful, versatile, renewable resources, providing simultaneously a wide range of economic, social, environmental and cultural benefits.

As the world wide demand for their numerous functions and outputs are increasing with the expanding population, the global forest resources are shrinking.

Thus for sustainable development, we should use our natural capital with almost care. We must take into account two key concepts:-

a) The essential needs of the worlds poor, which must get overriding priority.

b) The limitations imposed by the state of technology and social organizations, on the environmental ability to meet present and future needs.

CRISIS FACED BY THE FORESTS

Over the last two decades of the 20th Century, rapid deforestation has taken its toll, largely in the tropics.

a)

b)

Also the structural integrity of much of the forest cover that remains has deteriorated. The facts are startling:-

- Forests have virtually disappeared in 25 countries; 18 have lost more than 95% of their forests and another 11 have lost 90%.
- The current estimate of the world's forested areas is about 3.6 billion hectares from an originally forested of more than 6.0 billion hectors (fig 1and fig 2).
- About 14 million hectares of tropical forest have been lost each year since 1980 due to change in land use from forest to agriculture.
- Forest decline threatens the genetic diversity of the world's plants and animals.
- The world conversation union recently calculated that about 12.5% of the world's 270,000 species of plants, and about 75% of world's mammal are threatened by forest decline (fig.3).

THREATS TO FORESTS

Threats to forests can be categorized in three ways.

a) Competitions for other land uses, like expanding cropland

REMEDY

The solution is to bring an urgent green revolution by:-

i) Productivity breakthrough for staple crops grown by poor farmers, often on marginal lands.

ii) Diversified production using tree crops, live stock and variety of agricultural crops.

And the challenge for the new green revolution will be to develop technology that will make this a "Poor Farmer's green revolution"

b) Growing global demand for industrial wood which is expected to increase from 1.7 to 3 billion cubic meters per year by 2050

REMEDY

The possibilities for meeting and reducing these surging demands lie in:

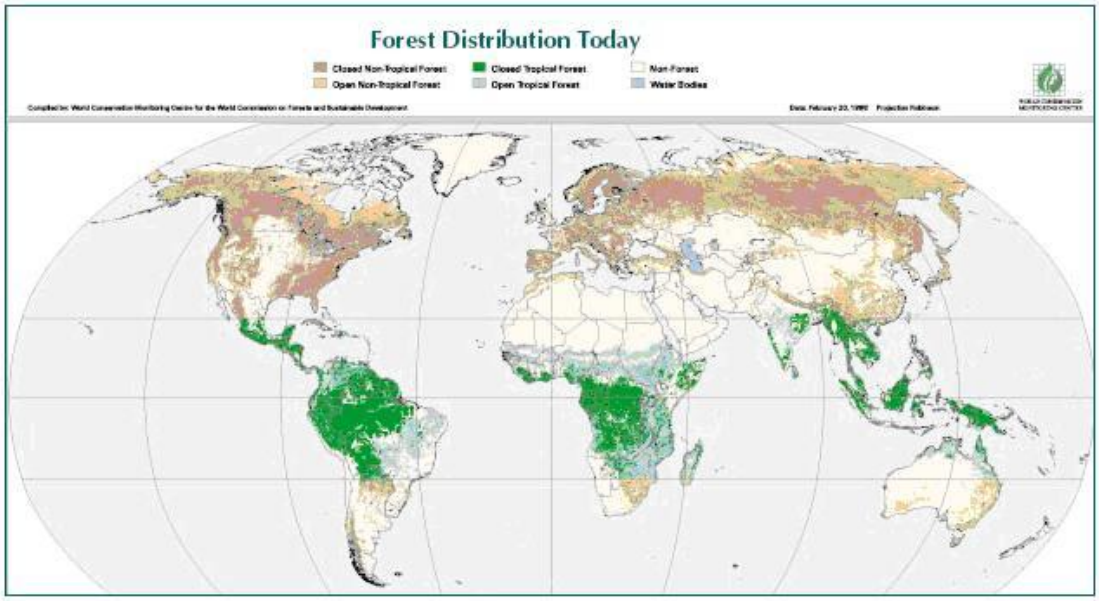
i) Improved technology for the production and use of wood.

ii) Reducing wasteful use of forest resources and increasing forest/ tree productivity.

iii) Recycling can considerably lesser the demand for industrial wood.

iv) Tree plantations can meet growing demands for industrial wood from a relatively small land base.

(a) Conserving remaining primary forests.



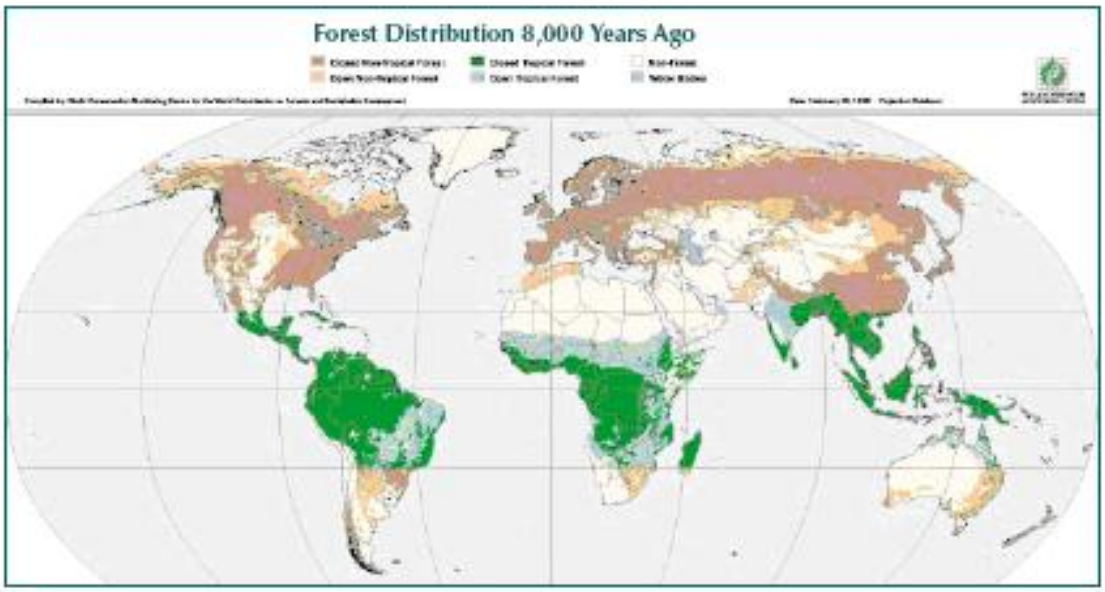


Fig. 1.2

Figure 1 & 2

(b) Increasing forest cover
(c) Increasing carbon sequestration
(d) Creating income and employment

c) Fuel wood demand

Wood is a major rural and industrial energy source. Fuel wood is used for 58% of all the energy used in Africa, 15% in Latin America and 11% in Asia.

In some 40 developing countries, fuel wood accounts for more than 70% of all the energy use. It is estimated that by 2050 demand for fuel wood will increase from 3.0 to 3.5 billion cubic meters per year (Fig. 4).

REMEDY

Rural energy alternatives should be encouraged through greater funding for research and development. Thus we should encourage:-

.

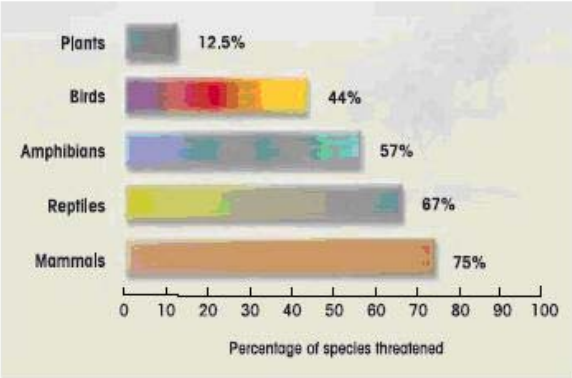


Figure 3

Figure 4

i) Innovative technologies e, such as new and more efficient kinds of wood burning stoves, solar and wind energy

ii) Agro forestry systems that produce fuel wood as by product.

iii) Give to private investors to develop energy plantations

CONSEQUENCES OF DEPLETING FORESTS

A) Loss of biodiversity

Forest contains at least two thirds of the earth's terrestrial species. The biotic diversity of forests is used in breeding economically important plants and animals. This gene bank is also drawn upon to strengthen the yield and resistance of domestic and commercial food corps and for materials of medicinal, pharmaceutical and industrial value. Plant diversity ensures a sufficiently wide range of tree species to better forests and their functions in regulating landscapes from disruption by pests, disease and the vagaries of climate. The present rates of species extinction are between 100 and 1000 times the rates. Species extinction is occurring at a time when humans have been deliberately narrowing the gene pool through selection and breeding in orders to increase timber and agricultural yields. This reduces the resilience of forests to recover from disturbance. The fact is that even before species are lost the functional aspects of nature are severally impaired.

We must make policies to:-

a) Halt the loss of medicinal plants and their natural habitats.

b) Protect cultural diversity and the rights of native people to manage and use forests.

c) Protect sources of non wood forest products that provide food, income and livelihood to millions.

(B) Climate change

Changing climate of the world is of great concern. The10 warmest[1] years on record have been since 1991 and it is expected that the carbon-dioxide content of the air will be double by 2100.

It will enhance the green house effect and will result in a 1 to 5 degree centigrade increase in global temperature; resulting in a rise in sea level, leading to millions of climate refugees.

As sea level rises and coastal communities continue to grow and pump water from aquifers, salt water intrusion into ground water will because a greater problem.

- As the temperature of oceanic areas will be moderated by the heat capacity of water, land areas will warm more rapidly than the global average.
- Warming will also be greatest at higher latitudes, for the past climate change has affected the earth's Polar Regions to the greatest extent.
- Humidity effects, included in the heat index will exacerbate warming effects and warmer temperature also has an impact on ecosystem. Experts predict the north ward retreat of temperate tree species and also the northward advancement of tropical and subtropical species. Though individual species will respond differently to climate change, it is clear that the normal associations of plants and animal may be disrupted.
- Elevated CO2 may also affect climatic variability. Extremes kill plants and wildlife. Plants may be killed if the temperature falls below freezing for even a few hours. Like wise Birds and insects may die if temperature gets warm.
- Rain fall patterns-

Changing climate will change rainfall patterns. Drier conditions lead to increased wild fires while wetter conditions may result in more insect pests, like mosquitoes. Decreased CO2 in the atmosphere can stimulated plant growth but there is evidence that plants under elevated carbon dioxide contain less

nitrogen in their fall age, thus making them less nutritious to grazers.

FOR SUSTAINABLE DEVELOPMENT[2]

Thus it is clear that we are faced with a forest crisis with many dimensions and in whatever from it may appear, it needs our urgent attention.

As the health of a forest deteriorates, all of its functions and services are threatened. The protection of water sheds, the habitat it provides to maintain biodiversity and its role in storing carbon.

The effects an environment, economy and society interconnect and affect one another.

The doctrine of sustainability provides a mechanics for development to occur in harmony with environmental protection and enhancement. It is an integrated approach to all round development.

What needs to be done is to increase the productivity of the "Producer System" and the efficiency of the "User System" and to achieve this, the following steps is essential:-

i. Localized management and participatory decision making[3].

The sustainable resource use in most likely to occur, if local communities participate in managing the resources, planning and implementation of forestry projects.

Joint forest management widely adopted in India, has emerged highly successful and has restored India's degraded forest lands.

The responsibilities and benefits should be shared by local user groups with government forestry departments.

Thus J.F.M. agreement is an increasingly influential world wide model in attempts to reverse deforestation trends and uplift disadvantage rural groups.

ii. Landscape Planning

The key to successful economic development include a working landscape that provides a stable base for a variety of entrepreneurial activities. In the forested zone, some of the forests will be used for timber, fiber and fuel; others for non timber forest products. And some will be used as forest resources and for water supplies. Such a scenario can come about only through planning for the entire landscape.

Thus we need to institute a landscape planning and management approach, based on wide public participation and supported by reliable data and scientific knowledge.

iii. Controversial Forestry practices

Controversial forest management issues frequently dominate news headlines. Can clear cutting really be a sound management technique? Is there a place for tree plantation with few species? Should large areas of forest be set aside for environmental reasons? The appropriateness of these practices can only be decided for specific situations.

However, the principles of localized management, participatory decision making, landscape planning and ecosystem based management should be the frame work for assessing forest practices such as clear cutting, Plantation forestry, fire as a management tool and protected forest areas.

For internationally traded forest products, the various criteria indicators and certifications system should be harmonized. This will ensure competitiveness for the products of these countries adhering to sustainability standards.

iv. Private Sector Investment and Management

The private sector has a critical role to play in SFM. In most of the major wood producing countries of the developed world, the private sector is the largest owner or manager of forests. The role of the private sector in furthering SFM in developed as well as in developing countries is critical. Private capital flows to developing countries, in the form of investment and lending. Now it amounts to about 60% of development financing and has increased each year since 1991.

The trends of decreasing public and increasing private investments are expected to continue. In the last few years, foreign private sector investments in the forestry sector have rapidly increased in many of the forest rich countries of the developing world.

v. Improving Research and Information

The inadequacy of forest data and the incompatibility of various agencies involved in forest data gathering and analysis, is one of the major impediment is SFM.

Indian council for forestry research and education, an autonomous body of the ministry of Environment and forests holds the mandate to organize, direct and manage research and education in the field of forestry. It is also responsible for framing the overall forestry research Policy of the country and ensuring the best method of application of all sources of scientific knowledge to the solution of problems facing the forestry sector.

vi. International efforts

For proper sustainable development world wide, it is imperative that there is an intergovernmental dialogue on forests and the need for a forest convention. Group of countries which have most of the world's forests should come together and find ways and means for sustainability of ecosystem.

But for any international law to be effective it should consider the following fundamental realities.

a) Forests conservation costs are in reality investments for environment and sustainable development.

b) The fate of world's future is dependent on environmental stability

c) The intergovernmental dialogue should focus on common responsibilities to secure environmental stability.

d) There should be a pooling of resources among nations for environmental stability and sustainable development.

vii. Citizen's forum

It is a matter of satisfaction that the consciousness among citizens is increasing and people are becoming more motivated towards the conservation of forests.

Forest Trust- is one forum in which people from all parts of the world assembles, put their views and work constructively for conservation of forests.

Forest Watch- concept is about getting public involved in monitoring the forests.

For this:

a) A network can be established for information gathering analysis and dissemination.

b) There should be a mechanism for linking experts and communities.

c) There should be a link between local, national and international organizations involved in forest information gathering and dissemination.

d) A web site for bringing to public notice any abuse of the public trust in forests

CONCLUSION

Thus natural resources have to be utilized optimally to sustain the long term quality of environment in balance with human needs.

And this requires more than just technical adjustments.

They call for fundamental and far reaching changes in forestry practices.

The roots of the crisis are broad and deep and the solutions go well beyond the obligations and responsibilities of the forestry sector.

Correcting the root causes of forest decline will require patience, commitment and enlightened leadership.

Innovation is desperately needed if the world is to prevent the deepening of the forest crisis and we should be creative in our search for solutions.

Thus for forest conservation, initiatives already underway must be supported and new ways must be found to slow and ultimately reverse the trends.

We all have a stake in the future of world's forests.

We may not have a second chance. The choice is still in our hands.

REFERENCES

1. Houghton. R. A. 1998. "Forest and Warming of the Earth." In *Forests in a Full World*. G.M. Woodwell, ed. Report of the Scientific Committee, World Commission on Forests and Sustainable Development. (in draft)

2. 2. IISD. (International Institute for Sustainable Development) 1996. *The World Trade Organization and sustainable development: An independent assessment.* Winnipeg, Canada: IISD.

3. Jeffrey, R. 1997. Organizing Sustainability: NGOs and Joint Forest Management Agreements in India. *Edinburgh:* Centre for South Asian Studies, University of Edinburgh.