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Content

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fd'kksj Nk=kvksa esa ,Ml (AIDS) ds izfr tkx:drk dk v/;;u ,oa tkx:drk dk fodkl

Mk- l|"kek 'kekZ] fç;adk xgyksr

lkj l{ksi

एड्स मनुष्यों में फैलने वाली एक भयंकर बीमारियों में से एक हैं, जो कि विश्व के हर भाग में रहने वाले लोगों के जीवन के लिए एक खतरा बन चुकी है। जनसंख्या की दृष्टि से दुनिया का दूसरा सबसे बड़ा देश, भारत एचआईवी/एड्स के साथ जी रहे लोगों की संख्या के आधार पर दुनिया में तीसरे स्थान पर है। एड्स की भयावहता एवं महामारी के रूप में विस्तार को ध्यान में रखते हुए, सन् 1992 में भारत सरकार द्वारा पहला 'राष्ट्रीय एड्स नियंत्रण कार्यक्रम (एनएसीपी–प्रथम): 1992–1999' शुरू किया गया। इसके प्रबंधन हेतु 'राष्ट्रीय एड्स नियंत्रण बोर्ड (एनएसीबी)' का गठन किया गया और क्रियान्वयन के लिए 'राष्ट्रीय एड्स नियंत्रण संगठन (एनएसीओ: नाको)' स्थापित किया गया। सन् 1999 में 'एनएसीपी–द्वितीय: 1999–2006' व सन् 2007 में '(एनएसीपी–तृतीय): 2007–2012' प्रारम्भ किए गए। नाको के अन्तर्गत राज्य स्तर पर विभिन्न कार्यक्रमों के क्रियान्वयन के लिए राज्य एड्स नियंत्रण समितियों की स्थापना की गयी है। मध्यप्रदेश राज्य एड्स नियंत्रण समिति (एमपीएसएसीएस) की स्थापना 14 जुलाई, 1998 को की गयी।

,Ml (AIDS) ifjp;

एड्स (AIDS) का पूर्ण नाम ,Dok;MZ bE;quks fMfQf'k,Ulh flUMªkse (Acquired Immuno Deficiency Syndrome) है। अर्थात् शरीर की रोग प्रतिरोधक क्षमता के न्यून/नष्ट हो जाने के फलस्वरूप प्राप्त किए हुए या उत्पन्न विभिन्न लक्षणों के सम्मिश्रण का चिकित्सकीय नाम एड्स है। एड्स एक एचआईवी नामक विषाणु के द्वारा होता है, जिसका पूर्ण नाम áeu bE;quks fMfQf'k,Ulh ok;jl (Human Immunodeficiency Virus-HIV) है। सर्वप्रथम सन् 1981 में सीडीसी (Centre For Disease Control) एटलांटा में डॉ. गॉटलिब द्वारा एड्स बीमारी को देखा गया। सन् 1984 में पाश्चर इन्स्टीट्यूट, पेरिस में डॉ. ल्यूक मान्टेगनियर ने एड्स वायरस का पृथक्करण और पहचान की। भारत में इसे सर्वप्रथम 1986 में राजस्थान के पुष्कर जिले में देखा गया। एड्स एक एचआईवी नामक विषाणु के द्वारा होता है, जिसका पूर्ण नाम áeu bE;quks fMfQf'k,Ulh ok;jl (Human Immunodeficiency Virus-HIV) है। यह विषाणु शरीर की सहायक T' कोशिकाओं के सम्पर्क में आकर, उन्हें नष्ट का देता है, परिणामस्वरूप रोग ग्रसित व्यक्ति का प्रतिरक्षा तंत्र (Immune System) कमज़ोर हो जाता है एवं व्यक्ति की विभिन्न रोगों व संक्रमणों से लड़ने की क्षमता नष्ट हो जाती है, अंततः रोगी व्यक्ति की मृत्यु हो जाती है। एड्स संक्रमण के अग्र कारण हो सकते हैं– असुरक्षित यौन सम्बन्ध (विषमलैंगिक एवं समलैंगिक) द्वारा, संक्रमित सुई एवं सिरिंजों एवं उनके द्वारा शरीर में प्रवेशित करायी जाने वाली दवाइयों से, संक्रमित रक्त के आदान–प्रदान के कारण, संक्रमित गर्भवती माँ से नवजात शिशु में, अंग प्रत्यारोपण द्वारा, एवं नम चुम्बन (Wet Kissing) या लार युक्त चुम्बन से। एड्स के प्रमुख लक्षण अग्र हैं– शरीर के भार में अचानक कमीं, लसिका ग्रंथियों में लगातार सूजन, रात में अत्यधिक पसीना आना व कॉंपना, लम्बे समय तक बुखार का लगातार बना रहना, मुँह तथा जीभ पर सफेद दाग या छाले और चमड़ी में खुजली होना, एवं शारीरिक रूप से अत्यधिक कमजोर होना। एड्स की पहचान दो प्रकार की जाँच द्वारा की जाती हैं– प्रारम्भिक जाँच (Screening Test) एलिसा (Enzyme-linked immunosorbent assay: ELISA) परीक्षण के द्वारा की जाती है। प्रारम्भिक जाँच के पश्चात् पुष्टिकारक जाँच (Confirmatory Test) वेस्टर्न ब्लॉट परीक्षण द्वारा की जाती है।

vkfpR;

आज एड्स तेजी से विश्व में फैल रहा है। भारत भी एचआईवी/एड्स संक्रमण में अछूता नहीं है। एड्स मुख्यतः किशोर/युवा वर्ग की समस्या है। चूँकि किसी भी समाज/राष्ट्र का प्रमुख आधार, उस समाज/राष्ट्र का किशोर व युवा वर्ग होता है। अतः एड्स न केवल एक शारीरिक समस्या है वरन् यह एक सामाजिक/राष्ट्रीय/वैश्विक समस्या है। किशोर/युवा वर्ग में एड्स संक्रमण का सबसे प्रमुख कारक इस वर्ग की एचआईवी व एड्स के प्रति अनभिज्ञता है। दूसरा प्रमुख कारण अपने परिवारजनों, अभिभावकों/पालकों व शिक्षकों के प्रति आदर व सम्मान का भाव तथा किशोरों व युवाओं को जन्मजात प्राप्त व सभ्यता–सस्ंकृतिजन्य संकोची स्वभाव (मुख्यतः भारतीय परिवेश में) है, जिसके कारण किशोर व युवा लैंगिक विषयों पर वार्ता करने में भय का अनुभव करते हैं, विशेषकर किशोर उम्र की छात्राएँ। परिणामस्वरूप लैंगिक विषयों व रोगों के प्रति मौन, अस्पष्टता, विभ्रम, विभिन्न स्वास्थ्य सम्बन्धित जोखिमों की जानकारी का अभाव तथा लैंगिक विषयों व यौन सम्बन्धों के सुरक्षित विकल्पों के ज्ञान का अभाव इत्यादि किशोर उम्र की छात्राओं को इस रोग की संक्रामकता की चपेट में ले आता है। साथ ही साथ अनभिज्ञता के किशोर उम्र की छात्राओं में एड्स से सम्बन्धित विभिन्न भ्रांतियाँ विकसित हो रही रही है। अतः इन तथ्यों को ध्यान में रखते हुए, इस बात की स्पष्ट आवश्यकता प्रतिपादित होती है कि किशोर उम्र की छात्राओं को एड्स के सम्बन्ध में विस्तृत जानकारी प्रदान की जाए, एड्स संक्रमण से रोकथाम एवं बचाव के उपाय किए जाए, एचआईवी/एड्स ग्रसित व्यक्तियों के प्रति सकारात्मक दृष्टिकोण का विकास किया जाए, एवं एचआईवी/एड्स संबंधी विभिन्न भ्रांतियों से बचा जा सके एवं इसके महामारी के रूप में विस्तार से बचाव किया जा सके। इस सन्दर्भ में किशोर उम्र की छात्राओं में

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एड्स के प्रति जागरूकता लाना अत्यन्त जरूरी है। इन बातों के परिप्रेक्ष्य में प्रस्तुत अध्ययन एक प्रयास मात्र है।

mís';
प्रस्तुत अध्ययन के दो उद्देश्य थे–

1. छात्राओं में एड्स के प्रति जागरूकता का अध्ययन करना।
2. छात्राओं में एड्स के प्रति जागरूकता का विकास करना।

ifjdYiuk
प्रस्तुत अध्ययन की परिकल्पना थी– ''एड्स जागरूकता कार्यक्रम द्वारा छात्राओं के एड्स के प्रति जागरूकता में सार्थक रूप से विकास होगा।''

U;kn'k
प्रस्तुत अध्ययन की समष्टि छात्रावास में रहकर अध्ययन करने वाली किशोर छात्राएँ थी। इन छात्राओं की समष्टि में से न्यादर्श के रूप में उद्देश्यपरक न्यादर्शन तकनीक द्वारा कुल 26 छात्रावासी छात्राओं का चयन किया गया। इन विद्यार्थियों की उम्र 16–22 वर्ष के मध्य थी। इन विद्यार्थियों में शहरी एवं ग्रामीण दोनों आवासीय पृष्ठभूमि वाले विद्यार्थी सम्मिलित थे। इन विद्यार्थियों का सामाजिक–आर्थिक स्तर काफी हद तक एक जैसा अर्थात् मध्यम था।

iz;kxkRed ikdYi
प्रस्तुत अध्ययन की प्रकृति प्रयोगात्मक थी। अध्ययन में ''एकल सूमह पूर्व परीक्षण–पश्च परीक्षण प्राकल्प (Pretest-Posttest Single Group Design)'' का उपयोग किया गया। प्राकल्प का सांकेतिक रूप इस प्रकार है–

0 × 0 (केम्पबेल एवं स्टेनले, 1963)

जहाँ –
0 = परीक्षण (एड्स जागरूकता परीक्षण),
×0 = उपचार (एड्स जागरूकता कार्यक्रम)।

प्रस्तुत अध्ययन हेतु केवल एक प्रयोगात्मक समूह लिया गया। प्रयोगात्मक समूह के विद्यार्थियों को 'एड्स जागरूकता कार्यक्रम' द्वारा उपचार दिया गया। उपचार की अवधि 02 दिन की थी। अध्ययन में छात्रावासी किशोर छात्राओं की 'एड्स जागरूकता' आश्रित चर थी।

midj.k
प्रस्तुत अध्ययन हेतु छात्रावासी छात्राओं की 'एड्स जागरूकता' परिवर्ती से संबंधित प्रदत्त एकत्रित किए गए। इस परिवर्ती के आकलन हेतु शोधकर्ताओं द्वारा निर्मित ^,M~l tkx:drk i'ukoyh* का उपयोग किया गया। इस जागरूकता परीक्षण में एड्स रोग से संबंधित मुक्त अंत वाले प्रश्नों में से कुल 10 लघुउत्तरीय प्रकार के प्रश्नों को सम्मिलित किया गया था। परीक्षण की अवधि 30 मिनिट थी।

inZk lidyu
सर्वप्रथम न्यादर्श हेतु चयनित छात्राओं के छात्रावास निदेशक से शोध कार्य हेतु अनुमति ली गयी। न्यादर्श की संख्या अनुरूप शोध के आश्रित चर के आकलन हेतु आवश्यक 'एड्स जागरूकता प्रश्नावली' की छायाप्रतियाँ प्राप्त कर ली गयी। इसके पश्चात् चयनित छात्राओं को मौखिक रूप से दिशा–निर्देश देकर अध्ययन का उद्देश्य स्पष्ट किया गया। न्यादर्श हेतु चयनित छात्राओं को 'एड्स जागरूकता कार्यक्रम' द्वारा पढ़ायी जाने वाली विषयवस्तु पर आधारित पूर्व–परीक्षण प्रश्नावली का प्रशासन किया गया। तत्पश्चात् सभी विद्यार्थियों को 'एड्स जागरूकता कार्यक्रम' द्वारा उपचार दिया गया। 'एड्स जागरूकता कार्यक्रम' के अन्तर्गत व्याख्यान (Lecture) विधि के माध्यम से छात्राओं को एड्स हेतु जागरूक बनाने का प्रयास किया गया। इसके द्वारा एड्स जागरूकता सम्बन्धित अग्र बिन्दुओं के संबंध में जानकारी प्रदान की गयी– विभिन्न यौन रोग, एड्स रोग का परिचय, यौन रोग व एच. आईव्र वी./एड्स में सबंध, एड्स संक्षिप्त इतिहास, एड्स का तेजी से बढ़ता प्रवाह, एड्स के कारक एवं संक्रमण, एचआईवी की संरचना एवं जीवनचक्र, रोग के लक्षण, जाँच एवं पहचान व उनके केन्द्र, रेड रिबन क्लब व उसका एच. आई. वी. से संबंध, सम्भावित उपचार, एच. आई वी./एड्स संक्रमितों के उपचारों के लिए सेवाएँ, बचाव एवं एड्स से सम्बन्धित भ्रांतियाँ व उनके निवारण में रेड रिबन क्लब की भूमिका। कुल 02 दिनों तक उपचार प्रदान किया गया। उपचार के पश्चात् समस्त छात्राओं से एक पश्च–परीक्षण प्रश्नावली भरवायी गयी।

inZk fo'ys"k.k
प्रस्तुत अध्ययन में 'एड्स जागरूकता कार्यक्रम' द्वारा उपचारित विद्यार्थियों के पूर्व एवं पश्च परीक्षण प्रश्नावली द्वारा एड्स जागरूकता की तुलना करने हेतु ifr'kr eku का उपयोग किया गया।

ifj.kke ,oa 0;k[;k& प्रदत्त विश्लेषण से प्राप्त परिणाम को प्रश्नवार सारणी 1.1 में प्रदर्शित किया गया है–

Lkkj.kh 1-1% प्रश्नवार छात्रावासी छात्राओं के एड्स की जानकारी प्रदान करने के पूर्व और पश्चात् प्रतिशत को दर्शाती तालिका

l-d-	i'u	,M~l d~l lEc/k e~ Tkkudkjh inku djus d~s iwoZ ifr'kr eku		,M~l d~l lEc/k e~ Tkkudkjh inku djus d~s i'p ifr'kr eku	
		lgh mRrj nus okyh Nk=kvksa dh la[;k o ifr'kr	lgh mRrj ugh nus okyh Nk=kvksa dh la[;k o ifr'kr	lgh mRrj nus okyh Nk=kvksa dh la[;k o ifr'kr	lgh mRrj ugh nus okyh Nk=kvksa dh la[;k o ifr'kr
01	एच. आई वी. एवं एड्स का पूर्ण रूप लिखें।	23 (88.46%)	03 (11.54%)	26 (100%)	00 (00%)
02	किन समूहों या व्यक्तियों में एच. आई वी./एड्स के	18	08	22	04

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	जोखिम की संभावना अधिक होती है?	(69.23%)	(30.77%)	(84.62%)	(15.38%)
03	एच. आई वी./एड्स संक्रमितों के उपचारों के लिए क्या सेवाएँ उपलब्ध हैं?	06 (23.08%)	20 (76.92%)	20 (76.92%)	06 (23.08%)
04	एच. आई वी./एड्स की जाँच कहाँ होती है?	10 (38.46%)	16 (61.54%)	26 (100%)	0 (00%)
05	रेड रिबन क्लब से आप क्या समझते है? इसका एच. आई वी./एड्स से क्या संबंध है?	18 (69.23%)	08 (30.77%)	22 (84.62%)	04 (15.38%)
06	यौन रोगों एवं एच. आई वी./एड्स में परस्पर क्या संबंध है?	11 (42.31%)	15 (57.69%)	26 (100%)	0 (00%)
07	युवाओं में एच. आई वी./एड्स संक्रमण के प्रमुख कारण क्या है?	22 (84.52%)	04 (15.38%)	26 (100%)	0 (00%)
08	एच. आई वी./एड्स संक्रमित व्यक्ति के प्रति कलंक और भेदभाव को दूर करने में रेड रिबन क्लब की क्या भूमिका है?	16 (61.54%)	10 (38.46%)	20 (76.92%)	06 (23.08%)
09	आपके व्यवहार में युवाओं को सुरक्षित व्यवहार की जानकारी किस प्रकार दी जा सकती है?	11 (42.31%)	15 (57.69%)	21 (80.77%)	03 (11.53%)
10	'जेन्डर' एवं 'सेक्स' में क्या अन्तर है? क्या आप अपने आपको युवाओं में एच. आई वी./एड्स एवं जीवन कौशलों की शिक्षा के लिए एक अच्छा प्रशिक्षक मानते हैं एवं क्यों?	05 (19.23%)	21 (80.77%)	20 (76.92%)	06 (23.08%)

सारणी 1.1 में एच. आई. वी./एड्स से संबंधित जागरूकता के लिए छात्रावासी छात्राओं द्वारा दिए गए प्रत्येक प्रश्न के सही एवं गलत उत्तरों की संख्या एवं उनके प्रतिशत दिए गए हैं। तालिका से ज्ञात होता है कि अधिकांश प्रश्नों पर गलत उत्तर देने वाली छात्राओं की संख्या एवं उनका प्रतिशत मान, सही उत्तर देने वाली छात्राओं की संख्या और उनके प्रतिशत मान से अधिक है। अर्थात् एड्स जागरूकता कार्यक्रम से पूर्व छात्राओं को एच. आई. वी./एड्स के संबंध में बहुत कम ज्ञान था। अतः यह निष्कर्ष रूप से कहा जा सकता है कि छात्रावासी छात्राओं में एच. आई. वी. /एड्स के प्रति जागरूकता का स्तर बहुत अधिक नहीं पाया गया।

सारणी 1.1 से पुनः स्पष्ट होता है कि एड्स जागरूकता कार्यक्रम के पश्चात् एच. आई. वी./एड्स से संबंधित जागरूकता प्रश्नावली के किसी भी प्रश्न पर छात्रावासी छात्राओं सही उत्तर देने का प्रतिशत मान 76.92: या उससे उच्च है। यह प्रदर्शित करता है कि एड्स जागरूकता कार्यक्रम के पश्चात् छात्रावासी छात्राओं के एच. आई. वी./एड्स के प्रति जागरूकता से संबंधित ज्ञान स्तर में वृद्धि हुई हैं और छात्राओं के एच. आई. वी./एड्स के प्रति जागरूकता के स्तर में विकास हुआ है। अतः यह निष्कर्ष रूप से कहा जा सकता है कि छात्रावासी छात्राओं में एड्स जागरूकता कार्यक्रम द्वारा, एड्स के प्रति जागरूकता स्तर में सार्थक रूप से विकास पाया गया।

fu"d"k

प्रस्तुत शोध से निम्न दो परिणाम प्राप्त हुए–

1. उपचार के पूर्व छात्रावासी छात्राओं में एच. आई. वी. /एड्स के प्रति जागरूकता का स्तर बहुत अधिक नहीं पाया गया।
2. एड्स जागरूकता कार्यक्रम द्वारा छात्रावासी छात्राओं में, एड्स के प्रति जागरूकता स्तर में सार्थक रूप से विकास पाया गया।

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Heavy metal toxicity and its harmful effects on human being

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ABSTRACT
Heavy metals and other contaminants that might affect human health as well as health of ecosystem. Which is dangerous for every human being and living organisms. pollution resulted in waste discharged from industrial activities, automobile exhausts and atomic power generation caused radioactive. Other reasons are climate changes such as uneven rain, droughts, extreme heat is summer and cold in winter. Heavy metal can have toxic effect on different organs. They can enter into water via drainage, atmosphere, soil erosion and all human activities by different ways. This paper reviews certain heavy metals and their biotoxic effects on man and the mechanism of their biochemical activities.

INTRODUCTION

Man in the name of development progress destroys or destruct the precious heritage of environment. . Industrial revolution increases the mans power while on the other hand added the poisonous substances in the environment i.e. pollutions. The harmful changes taking place in nature or the entrance of various toxic substances in environment causes unbalance in nature. Addition of undesirable substances in air, Water & Soil pollutes it and adversely effects the living-being According to Indian environment Act-1986 any Solid, Liquid or gas which is present in such a concentration which is harmful for environment is called pollutant. Today air, water, Soil, Noise pollutions is present in every sphere of life. Domestic sewage & Untreated Chemical containing water, which contains Pb, Hg, Ag, Organo-Metallic compounds etc increases the water pollution which affects the living organisms, plants & humans. Solid waste, Waste discharged from chemical industries, Sprayed insecticides, plastic, ceramics, cement caused Soil pollution. Atomic power generation causes radioactive pollution.

Occurrence of Heavy Metals-

Toxic heavy metal are found naturally in the earth and become concentration as a result of human caused activities. The enter plant, animal and human tissues via inhalation, diet and manual handling. Cadmium a toxic metal, occurs in nature in association with zinc minral (1:200 in ZnS) lead the majar source of air borne lead is the combustion of leaded petrol/gasoline. Heavy metal ores include sulphides, such as iron, arsenic, lead, lead-zinc, cobalt, gold silver and nickel sulphides; oxides such as aluminium, manganese, gold, selenium and antimony. Some exist and can be recovered as both sulphide and oxide ores such as iron, copper and cobalt.

Harmful Effect of Heavy Metal contamination on Human being-

Living organisms require varying amounts of heavy metal. It is required by humans. All metals are toxic at higher concentration.The heavy metals lead (Pb), Mercury (Hg), Cadmium(Cd), Cupper(Cu), arsenic(As) Present in water causes oxidative stress, Redox imbalance, Which effects the functioning of enzymes & hormones in body. The toxic effect of these metals cause Produced many disorder of human being.

(i) Lead-The exposure can be through drinking water, food , soil, air and dust from old paint. The Pb is among the most recycled non-ferrous metals, so its secondary production has grown steadily. The more concentration of Pb may result in toxic effects is the disruption of the synthesis of heamoglobin(Hb), kidney disease, anemia, gradual paralysis of muscles, atrophy.

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Chronic lead poisoning results in vertigo, reticulocystosis, anorexia, vomiting and brain damage.

(ii) Mercury- The Hg is widely used in production of electric apparatus, batteries, lamp, vapour lamp. It is also used in dentistry as an amalgam for fillings and in pharmaceutical industry. Inorganic forms of mercury cause congenital malformation and GI disorders (like corrosive esophagitis and hematochezia). Poisoning by its organic forms, which include monomethyl and dimenthylmecury presents with erethism (an abnormal irritation or sensitivity of an organ or body part to stimulation),acrodynia (Pink disease, which is characterized by rash and desquamation of the hands and feet), gingivitis, stomatitis, neurological disorders, total damage to the brain and CNS and are also associated with congenital malformation .

(iii) Cadmium- Tobacco smoke is an important source of Cadmium exposure. The Cd is mostly used in Ni/Cd batteries, rechargeable or secondary power sources, It is also used as pigment, stabilizer for PVC, in alloys and electronic compound. As an Impurity, it is present in several products, including phosphate fertilizers, detergents and refined petroleum products. Average daily intake of Cd for humans is 0.15 µ from air and 1µ from water. Cadmium toxicity causes anemia, hyper tension, adernal dysfunction, bone marrow disorders, carcinogen (respiratory and testicular, pancreatic cancer) damage to kidney lung and liver.

(iv) Chromium- The Cr has been reported to be used in, Stainless steel, Chrome plated metals, Pigments, refractory brick manufacture, and leather taning dyeing of fabrics and other Materials. The low level concentration of Cr Can irritate skin and Can produce ulcer. Its chronic exposure Can Produced kidney and liver damage and also damage is Circulatory and nerve tissue.

(v) Copper- The Copper is used in Mining, electroplating, Fly ash, Fertilizers, Copper Containing dust and water pipes. The Cu is essentially needed but in high doses, liver and kidney damage, and stomach, intestinal irritation may accur During wilson's disease.

Permissible Limits of heavy metals in plants:-

S.No.	Heavy metals	Permissible Value of plants (mg/kg)
01.	Cd (Cadmium)	0.02
02.	Cr (Chromium)	1.30
03.	Cu (Copper)	10
04.	Pb (Lead)	2

Methodology-

The proposed study is based on secondary data which are published in the Books, Journals, Websites and summary of different souvenirs of this particular topic.

Conclusion-

Heavy metals are useful to man being especially in the manufacturing of many products of human, but very harmful effect on human being. Only government lows / rules & polices are not enough to reduce environmental pollution. It is necessary to make people aware of the reasons & consequences of this, so that instead of harming the environment they will protect the environment & use the natural resources judiciously or prudently.

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APPLICATIONs OF ZEOLITE STILBITE FOR REMOVAL OF HEAVY METAL Cu(II) AND HYDROGEN SULPHIDE

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ABSTRACT
In this study the properties of partially Cu(II) exchanged Zeolite Stilbite and its hydrogen sulphide adsorbed derivative have been investigated by IR spectroscopic, thermogravimetric, atomic absorption and X-ray diffraction methods. Analytical data reported showed the extent of exchange. Thermal stability and structural changes of the derivates have been discussed. thermogravimetric data have been used to calculate kinetics of various thermal events. Cell parameters have been evaluated from XRD data. From the experiments, it can be concluded that zeolite Stilbite can successfully remove heavy metal Cu(II) and hazardous gas hydrogen sulphide.

INTRODUCTION

Rapid industrialization has led to increase disposal of heavy metal into the environment. Intense industrial and anthropogenic activities results in the contamination of environment with several contaminants, including heavy metals. Unlike organic contaminants, heavy metals are not biodegradable and tend to accumulate in living organisms and many heavy metal ions are known to be toxic or carcinogenic. These heavy toxic metals entered into the water bodies through waste water from several sources. When the concentration of these pollutants exceeds certain limits, their presence seriously endangers the environment and human health and remediation actions are necessary. Although copper is useful to human life and health, it is potentially toxic at higher concentration levels. Copper is extensively discharged from the electrical industry, pulp, paper mills and petroleum refineries [1].The most harmful pollutants, hydrogen sulfide (H_2S), is a biogas component , in a concentration range spanning from 10–30 to 1000–2000 ppm. Considering that exposure to concentration of only 300ppm for 30 min is enough to render a worker unconscious[2]. Zeolites are naturally occurring hydrated aluminosilicate minerals. They belong to the class of minerals known as “tectosilicates.” Most common natural zeolites are formed by alteration of glass-rich volcanic rocks (tuff) with freshwater in lakes or by seawater. The structures of zeolites consist of three-dimensional frameworks of SiO_4 AlO_4 tetrahedra. The aluminum ion is small enough to occupy the position in the center of the tetrahedron of four oxygen atoms, and the isomorphous replacement of Si^{4+} by Al^{3+} produces a negative charge in the lattice. The net negative charge is balanced by the exchangeable cation (sodium, potassium, or calcium). These cations are exchangeable with certain cations in solutions such as lead, cadmium, zinc, copper, and manganese [3,4] The fact that zeolite exchangeable ions are relatively innocuous (sodium, calcium, and potassium ions) makes them particularly suitable for removing undesirable heavy metal ions from industrial effluent waters. Stilbite is a natural zeolite. Chemical formula of Stilbite is $NaCa_4Al_8Si_{28}O_{72}.28H_2O$. The present work involves the use of zeolite Stilbite for preparing its cation-exchanged derivative with Cu(II) ions and using it for the adsorption of Hydrogen Sulphide. Characterizations of such derivatives have been done to make them useful to control environmental pollution.

Material and Methods

The Stilbite specimen, from the region around Deccan trap, was obtained from GST, Pune. It was finely powered in a mechanical grinder and sieved to obtain uniform particle size. In order to remove the soluble impurities, sample were washed at 70^0C for 6 hours with continuous stirring. Then the sample were drained and dried at 110^0C overnight. The partially Cu(II) exchanged derivative of Stilbite was

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prepared by treating 10g of the finely powered form of Stilbite with 500 ml of 0.1 M aqueous solution of Cu(II) nitrate at temperature 25^0C in a 500 ml plastic bottle. The bottle was shaken for 20 hours. Filtering, washing and air drying resulted in the formation of a light green exchanged derivative of Cu(II) Stilbite. The adsorbed derivative of this exchanged form with Hydrogen Sulphide was prepared by the procedure described in an earlier communication[5]. Color of adsorbed sample was black. The Cu(II) exchanged Stilbite was analyzed for Sodium(1), Calcium(II) and aluminium(III) using Varian Techtron AA-6 atomic absorption spectrometer. TG analysis of exchanged and adsorbed samples was carried out in air at a heating rate of 10°C per minute up to 800°C on a thermo balance supplied by FCI Sindri. IR spectra of the samples and their residues after heating up to 500°C in a muffle furnace was recorded in KBr phase between 4000 Cm^{-1} and 200 Cm^{-1} on a Perkin Elmer IR spectrophotometer. X-ray diffractograms were obtained between 2 Θ angles of 5° and 70° using a Philips PW 1140 X-ray unit and copper Kα radiation.

Results and discussion

Analytical data obtained for Stilbite and Cu(II) exchanged Stilbite are shown in table 1. During ion exchange reaction 68.10% of Ca(II) and 67.70% of Na(I) are replaced by Cu(II) ions. The Na/Al and Ca/Al ratio in the original Stilbite are lowered from 0.076 to 0.029 and 0.58 to 0.23 respectively as a result of cation exchange.

IR Spectral Analysis

IR spectra of Cu(II) exchanged Stilbite and its hydrogen sulphide adsorbed derivative and also their residues after heating up to 800°C are reported in the region between wave number 4000-200 cm^{-1}. Summary of IR spectral data is shown in table 2. IR Spectra of Cu(II) exchanged Stilbite shows typical hydrated structure but the intensities of the IR spectral bands of Stilbite are enhanced to a considerable extent as a result of exchange with Cu(II) ions. Both physical and chemical adsorption of hydrogen sulphide occur on Cu(II) exchanged Stilbite. A band at 2320 cm^{-1} is attributed to H-S linkage of hydrogen sulphide and the band at 450 cm^{-1} suggests the formation of sulphide species besides T-O bending. A shoulder band at 1380 cm^{-1} shows the physical adsorption of hydrogen sulphide. IR spectra of residue Cu(II) exchanged Stilbite and its hydrogen sulphide adsorbed derivative exhibit no band for physically adsorbed water or adsorbed species. It is also clear from the IR spectra of residue of both samples that structure of Zeolite is partially contracted and destroyed at high temperature. Both contractions and destructions are due to attractive force of extra framework cations[6]

Thermogravimetric Analysis

Cu(II) exchanged Stilbite shows a weight loss of only 20% on TG analysis. It is clear from TG data of Cu(II) exchange Stilbite that major step of weight loss occurs between 353k to 613k. Further weight loss beyond 613k takes place at a much slower rate. The hydrogen sulphide adsorbed derivative of Cu(II)) exchange Stilbite shows a weight loss of 28.06% on TG analysis. It loses weight in four steps. After dehydration and desorption proceeding up to 853k continuous oxidation of sulphide begins and proceeds very fast up to 1073k. TGA is used to calculate kinetics of various thermal events by the method described in earlier communication[7] Thermal data and kinetics parameters of different steps are shown in table 3.

X-ray Diffraction Analysis

Crystal structure of Stilbite is monoclinic c/2m with a=13.63, b=18.25, c=11.31 and β=128.4^{08}. Cu(II) exchanged Stilbite produced some variations in X-ray diffractogram in comparison to Stilbite. It shows decrease in intensities of the peaks. Adsorption of hydrogen sulphide on Cu(II) exchanged Stilbite produces some variations in the diffractogram. The (001) reflection at 8.84A^0 becomes more intense and (520) and (044) reflections at 2.04 A^0 and 1.88 A^0 respectively become diffused and indistinct.

Conclusion

Based on the present investigation it can be concluded that adsorbent Stilbite exhibits good ion exchange properties for Cu^{2+} ions in aqueous solutions. The exchanged form is capable of adsorbing undesirable gaseous adsorbate like H_2S by both physical and chemical adsorption. The main result of this work confirms that introduction of Cu(II) ion into the zeolite Stilbite structure considerable enhances the adsorption capacity for

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H_2S in comparison to original Stilbite which was described in our earlier communication[5].

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Table 1 Analytical data

Sample	Na %	Ca%	Al%
Stilbite	0.62	4.76	8.15
Cu(II) exchanged Stilbite	0.19	1.51	7.00

Table 2 Summary of IR spectral data

Sample	IR Peak(Wave number cm^{-1})	Assignment
Cu(II) exchanged Stilbite	3620SB	O-H stretching
	1660S	O-H bending
	1040SB	Asymmetric T-O stretching
	710SH	Symmetric T-O streteching
	565W	Double rings
	445W	T-O bending
	360SH	Pore opening
Cu(II) exchanged Stilbite + Hydrogen Sulphide	3460WB	O-H stretching
	2320W	H-S stretching
	1640 S	O-H bending
	1380SH	Physically adsorbed H_2S
	1030S	Asymmetric T-O stretching
	560M	Double rings
	450S	T-O bending,Cu-S linkage
	350SH	Pore openings
Residue of Cu(II) exchanged Stilbite	3420VW	O-H Stretching
	1020W	Asymmetric stretching
	465M	T-O bending
Residue of Cu(II) exchanged Stilbite + Hydrogen Sulphide	1040VW	Asymmetric T-O stretching
	460W	T-O bending

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S-Strong
B-Broad
M-Medium
W-Weak
SH-Shoulder
VW-Very Weak

Table 3 Thermal data and kinetics parameters

Sample	Total weight loss %	Weight loss steps% with temperature	Rate of reaction from g(α)Vs time value for n=2. ($x10^{-2}$ min^{-1})	Activation energy from $log_e g(\alpha)/T^2$ Vs $10^3/T$ value for n=2. (KJ $Mole^{-1}$)
Cu(II) exchanged Stilbite	20.00	14.04 up to 613k 2.47 up to 633k 3.49 after 633 k	5.42 8.00 0.88	18.68 55.39 41.04
Cu(II) exchanged Stilbite +H_2S	28.06	3.06 up to 413K 15.28 up to 593k 3.34 up to 853 k 6.38 after 853 k	8.50 5.27 0.34 2.37	12.00 19.59 27.65 262.00

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The effect of recent vdW potentials on the cohesive energy of alkali halides within the frame work of Harrison's potential model

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ABSTRACT
In present paper the effect of recent vdW potentials has been undertaken with a view to provide a detailed comparison of the the Harrison's model for ionic crystals and the old widely accepted Born - Mayer model for interionic potentials. For this purpose, we have selected alkali halide crystals.

INTRODUCTION

The cohesive energy of an ionic solid in specified thermodynamic conditions, is defined as the internal energy of the solid relative to the state of the free ions at absolute zero temperature. The crystal energy W can be expressed in the following form (Born and Mayer 1932, Huggins and Mayer 1933, Huggins 1937)

$W = W_e + \phi + W_V$ -------- (1)

Where W_e represents the coulomb or electrostatic energy between ions, also known as Madelung energy.

$W_R = \phi$ is the Born-Mayer repulsive energy.

W_V is the van der Waals energy. Thus the lattice energy of an ionic crystal can be written as follows :

$$W = -\frac{\alpha_m e^2}{r} + W_R - \frac{C}{r^6} - \frac{D}{r^8} \qquad \text{-------- (2)}$$

Where first term is the electrostatic or Madelung energy.

W_R is the symbol for repulsive energy. The W_V is replaced by two terms

$$\left(-\frac{C}{r^6} - \frac{D}{r^8}\right)$$ van der Waals energy.

In most of the application of Born model subsequent to 1930, the repulsive energy of the two closed shell ions has been assumed to vary exponentially with the separation, in keeping with quantum mechanical results (Heitler and London 1927, Slater 1928). The evaluation of lattice energy of an ionic crystal requires, then the determination of two repulsive parameters only if the total repulsive energy as a function of the nearest neighbour distance r, is written in the form

$W_R = B \exp(-r/\rho)$ -----(3)

Where B and ρ are known as the strength and hardness parameters respectively.

An instantaneous dipole moment of magnitude μ_1 of one atom produces an electric field E of magnitude $(2\mu_1 / r^3)$ at the centre of the second atom at a distance r from the centre of the first atom. This field will induce a dipole moment $\mu_2 = \alpha E = \left(2\alpha\mu_1 / r^3\right)$ on the second atom, where α is the electronic polarizability defined as the dipole moment per unit electric field. Since the two dipole moments are parallel, their potential energy is attractive and is given by

$W = -2\mu_1 \mu_2 / r^3 = -4\alpha \mu_1^2 / r^6$ ----(4)

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We can write interaction as :

$$W = C/r^6 \qquad \text{----(5)}$$

With $W = C = 4\,\alpha\,\mu_1^2$ Where C is a Constant.

Considering dipole-dipole (W_{dd}) and dipole-quadrupole (W_{dq}) interactions only van der Waals energy may be expressed as

$$W = -\frac{C}{r^6} - \frac{D}{r^8}$$

Considering van der Waals potential also, the total energy in typical ionic crystal like alkali halides can be written as :

$$W = \frac{\alpha_m e^2}{r} + \phi_{+-} + \phi_{--} + \phi_{++} - \frac{C}{r^6} - \frac{D}{r^8}$$

Sustituting the values ϕ_{+-} of ϕ_{--} and ϕ_{++} in (1) we have

$$W = 6\,n_0 \frac{h^{-2}}{2m}\left[r_0\mu^{-3}e^{-kur_0} + \sqrt{2}\mu_1^3 r_0 e^{-k\sqrt{2}\mu_1 r_0} + \sqrt{2}\mu_2^3 r_0 e^{-k\sqrt{2}\mu_2 r_0}\right] - \frac{1.7476e^2}{r_0} - \frac{C}{r_0^6} - \frac{D}{r_0^8}$$

For NaCl structure.

and

$$W = n_0 \frac{h^{-2}}{2m}\left[8\mu^{-3}e^{-kur_0} + 2\sqrt{3}\mu_1^3 r_0 e^{-\left(\frac{2k}{\sqrt{3}}\right)\mu_1 r_0} + 2\sqrt{3}\mu_2^3 r_0 e^{-\left(\frac{2k}{\sqrt{3}}\right)\mu_2 r_0}\right] - \frac{1.762675e^2}{r_0} - \frac{C}{r_0^6} - \frac{D}{r_0^8}$$

for CsCl structure.

After Calculating

$$\left(\frac{dW}{dr}\right)_{r=r_0} \quad and \quad \left(\frac{d^2W}{dr^2}\right)_{r=r_0}$$

For NaCl and CsCl structure, we have calculated the values of no and k from the given input data. The values of n_0 and k are given in Table 1. In table 1 a comparison is made with the values of no and k without vdW interaction.

Table 01 : Calculated Values of Parameters

Crystal	Value Calculated including vdW interactions		Values Calculated ignoring vdW interactions	
	n_0	K	n_0	K
LiF	4.0	1.35	3.1	1.34
LiCl	11.4	1.34	11.6	1.41
LiBr	10.0	1.26	9.5	1.34
LiI	27.8	1.34	61.6	1.57
Naf	12.3	1.49	115	1.54
Nacl	16.6	1.39	19.6	1.49
NaBr	37.6	1.49	39.7	1.52
NaI	24.9	1.34	48.3	1.53
KF	29.1	1.57	40.2	1.70
KCl	35.8	1.47	70.9	1.67
KBr	43.3	1.47	112.0	1.71
KI	29.4	1.35	64.5	1.57
RbF	42.4	1.60	78.2	1.79
RbCl	67.6	1.56	230	1.85
RBCl	66.0	1.51	259	1.83

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RbI	68.7	1.47	372	1.83
CsF	66.8	1.63	198	1.92
CsCl	76.1	1.57	974	2.08
CsBr	56.3	1.48	752	2.01
CsI	53.1	1.42	728	1.95

Values of van der Waals coefficient C and D are taken Kirkwood Muller formula. Calculated values of separation energy are given in table :

Table 02 : Values of Separation Energy

Crystal	Values Calculated Ignoring van der Waals Interactions	Obtained by Harrison	obtained by Tosi	Experi-mental	Calculated Value by considering van der Waals Interaction
LIF	249.13	--	246.1	242.48	269.86
LICl	195.45	--	198.1	200..14	205.34
LIBr	188.57	--	186.9	191.9	192.5
LiI	176.64	--	169.5	179.16	183.17
NaF	222.56	390.27	215.18	215.5	232.56
NaCl	184.90	266.92	18307	184.21	189.36
NaBr	175.72	244.97	173.3	175.26	186.05
KF	195.45	359.98	191.18	191.09	199.73
KCl	167.46	241.68	165.6	167.46	172.8
KBr	161.04	221.33	159.3	160.39	166.9
KI	149.80	196.96	149.2	152.09	155.81
RbF	186.27	352.77	184.4	183.06	191.95
RbCl	162.19	236.08	160.9	161.27	167.9
RbBr	155.07	215.72	153.6	154.85	160.56
RbI	146.36	192.04	145.5	147.27	153.5
CsF	177.33	--	178.6	174.34	183.17
CsCl	152.78	--	153.6	157.37	162.6
CsBr	146.59	--	147.9	151.63	155.66
CaI	137.87	--	140.1	144.59	147.6

conclusion

Since we have already used the interionic separation and Bulk modules data to obtain parameters n_0 and k, hence we have to calculate some other properties to judge the validity of potential form used. These are separation or cohesive energies. Values of separation energies calculated by including vdW interactions are greater than values calculated by ignoring these interactions. Although the

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inclusion of vdW interaction increases the repulsive forces, but this increase does not over compensate the inclusion of vdW interactions and therefore the cohesive energy with vdW interaction is shift higher than the corresponding of cohesive energies.

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Biomaterials : An Overview

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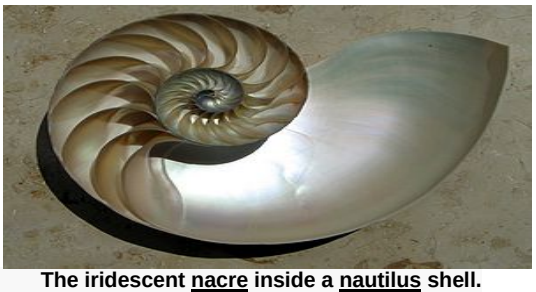
ABSTRACT
A biomaterial is now defined as a substance that has been engineered to take a form which, alone or as part of a complex system, is used to direct, by control of interactions with components of living systems, the course of any therapeutic or diagnostic procedure. The first biomaterials used were gold and ivory for replacements of cranial defects. biomaterial as ‘‘any substance or combination of substances, other than drugs, synthetic or natural in origin, which can be used for any period of time, which augments or replaces partially or totally any tissue, organ or function of the body, in order to maintain or improve the quality of life of the individual’’. A biomaterials which are matters such as surface, or construct that interact with biological system. A biometrical comes under the specification as the size of nanoscale. It has vast applications in medicine , biology, chemistry, tissue engineering and material science. In the discussion of biomaterials, certain aspects such as biomineralization, nanosized particle(magnetosome),

INTRODUCTION



The iridescent nacre inside a nautilus shell.

A biomaterial is any matter, surface, or construct that interacts with biological systems. The development of biomaterials, as a science, is about fifty years old. The study of biomaterials is called biomaterials science. It has experienced steady and strong growth over its history, with many companies investing large amounts of money into the development of new products. Biomaterials science encompasses elements of medicine, biology, chemistry, tissue engineering and materials science.

Biomaterials origins stem from the use of synthetic materials (metals, polymer & ceramics) in diverse applications as vascular graphs, artificial hips and dental restorations. More recently the scope of the field has broadened to include studies of natural tissues, cellular structures, and biomacromolecules, sometimes collectively referred to as biological materials. The biomaterials field has rapidly expanded to incorporate additional interdisciplinary elements of the biomedical and physical sciences. Biointerfaces, bio-microdevices, controlled drug delivery, tissue engineering, and efforts to apply knowledge from cell and molecular biology to regenerate tissues and organs are now at the leading edge of biomaterials research. Biomaterials can be derived either from nature or synthesized in the laboratory using a variety of chemical approaches utilizing metallic components or ceramics. They are often used and/or adapted for a medical application, and thus comprises whole or part of a living structure or biomedical device which performs, augments, or replaces a natural function. Such functions may be benign, like being used for a heart valve, or may be *bioactive* with a more interactive functionality such as *hydroxy-apatite* coated *hip implants*. Biomaterials are also used every day in dental applications, surgery, and drug delivery. E.G. A construct with impregnated pharmaceutical products can be placed into the body, which permits the prolonged release of a drug over an extended period of time. A biomaterial may also be an *autograft*, *allograft* or *xenograft* used as a *transplant* material.

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Materials scientists are currently paying more and more attention to the process inorganic crystallization within a largely organic matrix of naturally occurring compounds. Interestingly, the vital organisms through which these crystalline minerals form are capable of consistently producing intricately complex structures. Understanding the processes in which living organisms are capable of regulating the growth of crystalline minerals such as silica could lead to significant scientific advances and novel synthesis techniques for nanoscale composite materials—or nanocomposites.

Biomaterials can be classified as synthetic or natural materials intended to either augment, direct, replace, repair or regenerate organs, tissues, or cells. The field of biomaterials employs the combination of concepts and experimental techniques used in materials science and engineering, as well as the biological sciences, to address the structure-property-performance relationships of biomaterials and the devices that employ them. Biomaterials is a rapidly emerging component of the materials research enterprise. Biomaterials research covers a broad range of activities that includes the development of materials used for delivery of therapeutic and diagnostic agents, construction of medical devices that must be compatible with living systems, and scaffolds for tissue engineering and regenerative medicine. Another aspect of biomaterials research involves exploiting mimicry of, inspiration by, or co-opting of biological systems to enable creation of novel functional materials.

One of the greatest challenges in the post-genomic era of the 21st century lies in making the essential connections between structure and function of biomolecules at the micro/nanoscale to human physiology and pathophysiology at the macroscale. Biological microelectromechanical systems (bioMEMS) and nanotechnologies such as oligonucleotide arrays, integrated fluidic chips, and drug delivery/sensing platforms promise to transform the world of biochemistry and medicine much in the same way that integrated semiconductor devices transformed the world of electronics. The key driving force is the complementary length scale between biological structures that range from the 10s of nanometers (proteins, DNA, viruses) to the micron scale (cells and cellular assemblies) and the new capabilities of micro/nanosystems to manipulate and control such feature sizes within our environment.

Silks are naturally occurring polymers that have been used clinically as sutures for centuries. When naturally extruded from insects or worms, silk is composed of a filament core protein, termed fibroin, and a glue-like coating consisting of sericin proteins. In recent years, silk fibroin has been increasingly studied for new biomedical applications due to the biocompatibility, slow degradability and remarkable mechanical properties of the material. In addition, the ability to now control molecular structure and morphology through versatile processability and surface modification options have expanded the utility for this protein in a range of biomaterial and tissue-engineering applications. Silk fibroin in various formats (films, fibers, nets, meshes, membranes, yarns, and sponges) has been shown to support stem cell adhesion, proliferation, and differentiation in vitro and promote tissue repair in vivo. In particular, stem cell-based tissue engineering using 3D silk fibroin scaffolds has expanded the use of silk-based biomaterials as promising scaffolds for engineering a range of skeletal tissues like bone, ligament, and cartilage, as well as connective tissues like skin. Electrospinning for the formation of nanoscale diameter fibers has been explored for high-performance filters and biomaterial scaffolds for vascular grafts or wound dressings. Fibers with nanoscale diameters provide benefits due to high surface area.

Biomineralization

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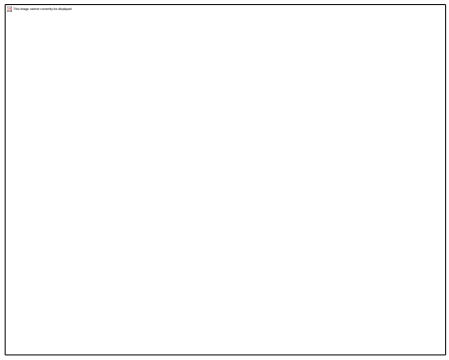

Calcitic skeletal parts of belemnites (Jurassic of Wyoming

Biomineralization is the process by which living organisms produce minerals, often to harden or stiffen existing tissues. Such tissues are called mineralized tissues. It is an extremely widespread phenomenon; all six taxonomic kingdoms contain members that are able to form minerals, and over 60 different minerals have been identified in organisms. Examples include silicates in algae and diatoms, carbonates in invertebrates, and calcium phosphates and carbonates in vertebrates. These minerals often form structural features such as sea shells and the bone in mammals and birds. Organisms have been producing mineralised skeletons for the past 550 million years. Other examples include copper, iron and gold deposits involving bacteria. Biologically-formed minerals often have special uses such as magnetic sensors in magnetotactic bacteria (Fe_3O_4), gravity sensing devices ($CaCO_3$, $CaSO_4$, $BaSO_4$) and iron storage and mobilization ($Fe_2O_3 \bullet H_2O$ in the protein ferritin).

In terms of taxonomic distribution, the most common biominerals are the phosphate and carbonate salts of calcium that are used in conjunction with organic polymers such as collagen and chitin to give structural support to bones and shells. The structures of these biocomposite materials are highly controlled from the nanometer to the macroscopic level, resulting in complex architectures that provide multifunctional properties. Because this range of control over mineral growth is desirable for materials engineering applications, there is significant interest in understanding and elucidating the mechanisms of biologically controlled biomineralization.

Chitin

a nitrogen containing polysaccharide, related chemically to cellulose, that forms a transparent horny substance and is a principal containing polysaccharide, related chemically to cellulose,that forms a semitransparent horn substance and is a
principal constituent of the exoskeleton, or outer c overing, of insects,crustaceans, and arachnids. Chitin $(C_8H_{13}O_5N)_n$ is a long chain polymer of a N acetyl glucos amine, a derivative of glucose, and is found in many places throughout the natural world. It is the main component of the cell walls of fungi ,the exoskeletons of arthropods such as crustaceans (e.g., crabs, lobsters and shrimps) and insects, the radulas of mollusks, and the beaks of cephalopods, including squid and octopuses. In terms of structure, chitin may be compared to the polysaccharide cellulose and, in terms of function, to the protein keratin. Chitin has also proven useful for several medical and industrial purposes. Chitin's properties as a flexible and strong material make it favorable as surgical thread. Its biodegradibility means it wears away with time as the wound heals. Moreover, chitin has some unusual properties that accelerate healing of wounds in humans. Occupations associated with high environmental chitin levels, such as shell fish processors, are prone to high incidences of asthma. Recent studies have suggested that chitin may play a role in a possible pathway in human allergic disease. To be specific, mice treated with chitin develop an allergic response, characterized by a build-up of interleukin-4, expressing innate immune cells. In these treated mice, additional treatment with a chitin as enzyme abolishes the response.

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Collagen

Collagen is a type of protein. Fibrous in nature, it connects and supports other bodily tissues, such as skin, bone, tendons, muscles, and cartilage. It also supports the internal organs and is even present in teeth. There are more than 25 types of collagens that naturally occur in the body. Collagen is one of the most plentiful proteins present in the bodies of mammals, including humans. In fact, it makes up about 25 percent of the total amount of proteins in the body. Some people refer to collagen as the glue that holds the body together. Without it, the body would, quite literally, fall apart. possessing great tensile strength, collagen functions in a manner that is very different from many other types of proteins. For example, it can be found both inside and outside of cells.Collagen fibers are important in contributing to the external structure of cells. However, they are present on the inside of some cells as well. Collagen works hand-in-hand with elastin in supporting the body's tissues. Basically, it gives body tissues form and provides firmness and strength; elastin gives the same body tissues much need flexibility. This combination of collagen and elastin is very important in many parts of the body, including, but not limited to, the lungs, bones, and tendons. Even the blood vessels rely on both collagen and elastin.

Collagen is a group of naturally occurring proteins found in animals, especially in the flesh and connective tissues of mammals. It is the main component of connective tissue, and is the most abundant protein in mammals, making up about 25% to 35% of the whole-body protein content. Collagen, in the form of elongated fibrils, is mostly found in fibrous tissues such as tendon, ligament and skin, and is also abundant in cornea, cartilage, bone, blood vessels, the gut, and intervertebral disc. The fibroblast is the most common cell which creates collagen. In muscle tissue, it serves as a major component of the endomysium. Collagen constitutes one to two percent of muscle tissue, and accounts for 6% of the weight of strong, tendinous muscles. Gelatin, which is used in food and industry, is collagen that has been irreversibly hydrolyzed. Often, collagen is discussed in relation to the skin. It works with keratin to provide the skin with strength, flexibility, and resilience. As people age, however, collagen degradation occurs, leading to wrinkles. As such, it is an important substance for those looking for ways to fight the visible effects of aging on the skin. Some skincare professionals actually advise people on ways to stimulate the production of collagen in skin cells.

Medical uses

In addition to being so important in the body, collagen also has many medical uses. It is used in some cosmetic surgery procedures and is sold as a supplement created for joint mobility. It is even used in treating and managing serious burns. For this purpose, it is used in creating man-made skin substitutes. Since collagens are so important within the body, it stands to reason that collagen deficiencies can be problematic. In fact, there are some genetic diseases that are associated with collagen deficiencies. For example, *osteogenesis imperfecta*, commonly referred to as brittle bone disease, results from a significantly decreased level of collagen. It can also result from the presence of collagen that is of lower quality than normal.

Cardiac applications

The four dense collagen valve rings, the central body of the heart and the cardiac skeleton of the heart are histologically bound to the myocardium. Collagen contribution to heart performance summarily represents an essential, unique and moving solid anchor opposed to the fluid mechanics of blood within the heart. This structure is an impermeable firewall that excludes both blood and electrical influence (except through anatomical channels) from the upper to the lower chambers of the heart. As proof, one could posit that a trial fibrillation almost never deteriorates

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to ventricular fibrillation. Individual valvular leaflets are held in sail shape by collagen under variable pressure. Calcium deposition within collagen occurs as a natural consequence of aging. Calcium rich fixed points in an otherwise moving display of blood and muscle enable current cardiac imaging technology to arrive at ratios essentially stating blood in cardiac input and blood out cardiac output. Specified imaging such as calcium scoring illustrates the utility of this methodology, especially in an aging patient subject to pathology of the collagen underpinning.

Cosmetic surgery

Collagen has been widely used in cosmetic surgery, as a healing aid for burn patients for reconstruction of bone and a wide variety of dental, orthopedic and surgical purposes. Both human and bovine collagen is widely used as dermal fillers for treatment of wrinkles and skin aging. Some points of interest are:

1. when used cosmetically, there is a chance of allergic reactions causing prolonged redness; however, this can be virtually eliminated by simple and inconspicuous patch testing prior to cosmetic use, and
2. most medical collagen is derived from young beef cattle (bovine) from certified BSE (bovine spongiform encephalopathy) free animals. Most manufacturers use donor animals from either "closed herds", or from countries which have never had a reported case of BSE such as Australia, Brazil and New Zealand.
3. porcine (pig) tissue is also widely used for producing collagen sheet for a variety of surgical purposes.
4. alternatives using the patient's own fat, hyaluronic acid or polyacrylamide gels which are readily available.

Reconstructive surgical uses

Collagens are widely employed in the construction of artificial skin substitutes used in the management of severe burns. These collagens may be derived from bovine, equine or porcine, and even human sources and are sometimes used in combination with silicones,glycosaminoglycans, fibroblasts, grow th factors and other substances.

Collagen is also sold as a pill commercially as a joint mobility supplement with poor references. Because proteins are broken down into amino acids before absorption, there is no reason for orally ingested collagen to affect connective tissue in the body, except through the effect of individual amino acid supplementation.

Although it cannot be absorbed through the skin, collagen is now being used as a main ingredient for some cosmetic makeup.

Collagen is also frequently used in scientific research applications for cell culture, studying cell behavior and cellular interactions with the extracellular environment. Suppliers such as Trevigen manufacture rat and bovine Collagen I and mouse Collagen IV.

Wound care management uses

Collagen is one of the body's key natural resources and a component of skin tissue that can benefit all stages of the wound healing process. When collagen is made available to the wound bed, closure can occur. Wound deterioration, followed sometimes by proce-dures such as amputation, can thus be avoided. Throughout the 4 phases of wound healing, collagen performs the following functions in wound healing:

Guiding Function: Collagen fibers serve to guide fibroblasts. Fibroblasts migrate along a connective tissue matrix.

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Chemotactic Properties: The large surface area available on collagen fibers can attract fibrogenic cells which help in healing.

Nucleation: Collagen, in the presence of certain neutral salt molecules can act as a nucleating agent causing formation of fibrillar structures. A collagen wound dressing might serve as a guide for orienting new collagen deposition and capillary growth.

Hemostatic properties: Blood platelets interact with the collagen to make a hemostatic plug. Suppliers such as Human Bio Sciences manufacture bovine type 1 collagen into wound care bandages.

Biological roles of Biominerals

Biominerals perform a variety of roles in organisms, the most important being support, defence and feeding. If present on a super-cellular scale, biominerals are usually deposited by a dedicated organ, which is often defined very early in the embryological development. This organ will contain an organic matrix that facilitates and directs the deposition of crystals. The matrix may be collagen, as in deuterostomes, or based on chitin or other polysaccharides, as in mollusks

Shell formation in molluscs

The **mollusc** (or **mollusk**[spelling 1]) **shell** is typically a calcareous exoskeleton which encloses, supports and protects the soft parts of an animal in the phylum Mollusca, which includes snails, clams, tusk shells, and several other classes. Not all shelled molluscs live in the sea, many live on the land and in freshwater. The ancestral mollusc is thought to have had a shell, but this has subsequently been lost or reduced on some families, such as the squid, octopus, and some smaller groups such as the caudofoveata and solenogastres, and the highly derived *Xenoturbella*. Today, over 100,000 living species bear a shell; there is some dispute as to whether these shell-bearing molluscs form a monophyletic group (conchifera) or whether shell-less molluscs are interleaved into their family tree. Malacology, the scientific study of molluscs as living organisms, has a branch devoted to the study of shells, and this is called conchology - although these terms used to be, and to a minor extent still are, used interchangeably, even by scientists (this is more common in Europe).Within some species of molluscs there is often a surprising degree of variation in the exact shape, pattern, ornamentation, and color of the shell.

The mollusc shell is a biogenic composite material that has been the subject of much interest in materials science because of its unusual properties and its model character for biomineralization. Molluscan shells consist of 95–99% calcium carbonate by weight, while an organic component makes up the remaining 1–5%. The resulting composite has a fracture toughness ~3000 times greater than that of the crystals themselves. In the biomineralization of the mollusc shell, specialized proteins are responsible for directing crystal nucleation, phase, morphology, and growths dynamics and ultimately give the shell its remarkable mechanical strength. The application of biomimetic principles elucidated from mollusc shell assembly and structure may help in fabricating new composite materials with enhanced optical, electronic, or structural properties.

Magnetosome

Magnetosome chains are membranous prokaryotic organelles present in magnetotactic bacteria. They contain 15 to 20 magnetite crystals that together act like a compass needle to orient magnetotactic bacteria in geomagnetic fields, thereby simplifying their search for their preferred microaerophilic environments. Each magnetite crystal within a magnetosome is surrounded by a lipid bilayer, and specific soluble and transmembrane proteins are sorted to the membrane. Recent research has shown that magnetosomes are invaginations of the inner membrane and not freestanding vesicles. Magnetite-bearing magnetosomes have also been found in eukaryotic magnetotactic algae, with each cell containing several thousand crystals. Overall, magnetosome crystals have high chemical purity,

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narrow size ranges, species-specific crystal morphologies and exhibit specific arrangements within the cell. These features indicate that the formation of magnetosomes is under precise biological control and is mediated biomineralization. Magnetotactic bacteria usually mineralize either iron oxide magnetosomes, which contain crystals of magnetite (Fe_3O_4), or iron sulfide magnetosomes, which contain crystals of greigite (Fe_3S_4). Several other iron sulfide minerals have also been identified in iron sulfide magnetosomes — including mackinawite (tetragonal FeS) and a cubic FeS — which are thought to be precursors of Fe_3S_4. One type of magnetotactic bacterium present at the oxic-anoxic transition zone (OATZ) of the southern basin of the Pettaquamscutt River Estuary, Narragansett, Rhode Island, USA is known to produce both iron oxide and iron sulfide magnetosomes

The particle morphology of magnetosome crystals varies, but is consistent within cells of a single magnetotactic bacterial species or strain. Three general crystal morphologies have been reported in magnetotactic bacteria on the basis: roughly cuboidal, elongated prismatic (roughly rectangular), and tooth-, bullet- or arrow head-shaped. Magnetosome crystals are typically 35–120 nm long, which makes them single-domain. Single-domain crystals have the maximum possible magnetic moment per unit volume for a given composition. Smaller crystals are superparamagnetic–that is, not permanently magnetic at ambient temperature, and domain walls would form in larger crystals. In most magnetotactic bacteria, the magnetosomes are arranged in one or more chains. Magnetic interactions between the magnetosome crystals in a chain cause their magnetic dipole moments to orientate parallel to each other along the length of the chain. The magnetic dipole moment of the cell is usually large enough such that its interaction with Earth's magnetic field overcomes thermal forces that tend to randomize the orientation of the cell in its aqueous surroundings. Magnetotactic bacteria also use aerotaxis, a response to changes in oxygen concentration that favors swimming toward a zone of optimal oxygen concentration. In lakes or oceans the oxygen concentration is commonly dependent on depth. As long as the Earth's magnetic field has a significant downward slant, the orientation along field lines aids the search for the optimal concentration. This process is called magneto-aerotaxis. While a single magnetosome chain would appear to be ideal for magneto-aerotaxis, a number of magnetotactic bacteria have magnetosomes or magnetosome arrangements that depart from the ideal. One reported example includes large (up to 200 nm) magnetosomes found in coccoid cells in Brazil. These cells have enough magnetosomes so that the calculated magnetic dipole moment of the cell is about 250 times larger than that of a typical cell of *Magnetospirillum magnetotacticum*. There are also examples of magnetotactic bacteria that contain hundreds of magnetosomes, many more than required for orientation. One large, rod-shaped organism, *Magnetobacterium bavaricum*, contains up to 1000 bulletshaped magnetosomes arranged in several chains traversing the cell. Some bacteria have magnetosomes that are not arranged in chains, but are clustered on one side of the cell. In such an arrangement, the shape anisotropy of each crystal provides the stability against remagnetization, rather than the overall shape anisotropy in the magnetosome chain arrangement. These non-ideal arrangements may be pointing to additional, currently unknown functions of magnetosomes, possibly related to metabolism

Magnetotaxis

The use of magnetic fields to navigate is found in a certain type of bacteria, called magnetotactic bacteria. These bacteria are crucial for understanding other forms of magnetoception in animals; these bacteria orient themselves based on Earth’s magnetic field in a process called magnetotaxis. Magnetosomes, particles of magnetite or iron sulfide within the miniscule boundaries of the magnetotactic bacteria, give the bacteria its ability to find the magnetic fields

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because of a magnetic dipole effect. Magnetotactic bacteria are essentially permanent magnets, as the magnetosomes align with each other to maintain sensitivity towards Earth's magnetic forces.

Logically, **magnetotaxis** describes an ability to sense a magnetic field and coordinate movement in response. It was applied to the behavior of certain motile, aquatic bacteria in 1975 by R. P. Blakemore. However, it is now known that these bacteria orient to the Earth's magnetic field even when they are dead, just as a compass needle does. Since the orientation is a result of a direct force acting on the bacteria, it has nothing to do with sensation. Thus, a better label for these bacteria is simply **magnetic bacteria**. These bacteria (e.g. *Magnetospirillum magnetotacticum*) contain internal structures known as magnetosomes. They appear as a chain of dark, membrane-bound crystals - often magnetite (Fe_3O_4). Some extremophile bacteria from sulforous environments have been isolated with greigite (an iron-sulfide compound Fe_3S_4). It has been suggested that by orienting toward the Earth's poles, marine bacteria are able to direct their movement downwards, towards the sediment. However, these bacteria are found even at the Earth's magnetic equator, where the field is directed horizontally. An alternative explanation is that by keeping the bacteria aligned against Brownian motion, they are more efficient at chemotaxis.

Magnetoception

Magnetoception is the ability for certain animals to orient themselves based on the earth's magnetic field. Magnetoception is used for navigational, altitude and location purposes by animals like fruit flies, bats, and other creatures. Magnetoception is an extraordinary ability that allows certain animals like honeybees create a map of the world they live in by magnet perception. This allows animals to know where to find food, where they live in addition to other facts about the world Researchers have studied animals with perceived magnetoception abilities including fruit flies, lobsters, and certain bacteria. Vertebrates with magnetoception include many species of birds, turtles, sharks, and some types of stingrays. **Magnetoception** (or **magnetoreception** as it was first referred to in 1972 is a sense which allows an animal to detect a magnetic field to perceive direction, altitude or location. This sense has been proposed to explain the navigational abilities of several animal species and has been postulated as a method for animals to develop regional maps. For the purpose of navigation, magnetoception deals with the detection of the Earth's magnetic field. Magnetoception has been observed in bacteria. It has also been commonly hypothesized in birds, where sensing of the Earth's magnetic field may be important to the navigational abilities during migration; fungi, insects (including fruit flies and honeybees), and animals such as turtles, lobsters, sharks and stingrays.

Proposed Mechanisms

While the study of magnetotactic bacteria has been fairly well established, but the ways in which animals are able to orient themselves based on Earth's magnetic fields are more uncertain. Two hypotheses have been put forward to explain the phenomena. The first is the Cryptochrome hypothesis, which states that cryptochrome, when exposed to blue light, is activated and forms a pair of radicals which can be parallel or anti-parallel. The power of the magnetic field around the animal affects the amount of time the cryptochrome stays active. The cryptochrome's activation is thought to increase light sensitivity which would allow the animal (like a bird) to essentially see the magnetic field and respond to its directional pull. This theory is faulted, however, by the weak magnetic field surrounding Earth and is therefore thought to affect an animal's sensitivity to light more so than their ability to sense a magnetic field. The second hypothesis is that the existence of iron oxide or magnetite in certain levels in an animal's body would have a physical effect on the animal's ability to detect a magnetic field. If these elements are present in an animal's body at high enough levels and are exposed to magnetism, they become permanently magnetized and could help steer the animal by the magnetic fields for the rest of its life.

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This is called the Magnetoreception hypothesis. An unequivocal demonstration of the use of magnetic fields for orientation within an organism has been in a class of bacteria known as magnetotactic bacteria. These bacteria demonstrate a phenomenal behaviorism known as magnetotaxis, in which the bacteria orients itself and migrates in the direction along the Earth's magnetic field lines. The bacteria contain magnetosomes, which are particles of magnetite or iron sulfide enclosed within the bacteria cells. Each bacterium cell essentially acts as a magnetic dipole. They form in chains where the moments of each magnetosome align in parallel, giving the bacteria its permanent-magnet characteristics. These chains are formed symmetrically to preserve the crystalline structure of the cells. These bacteria are said to have permanent magnetic sensitivity.

Another less general type of magnetic sensing mechanism in animals that has been thoroughly described is the inductive sensing methods used by sharks, stingrays and chimaeras (cartilaginous fish). These species possess a unique electroreceptive organ known as *ampullae of Lorenzini* which can detect a slight variation in electric potential. These organs are made up of mucus-filled canals that connect from the skin's pores to small sacs within the animal's flesh that are also filled with mucus. The ampullae of Lorenzini are capable of detecting DC currents and have been proposed to be used in the sensing of the weak electric fields of prey and predators. The sensing method of these organs is based on Faraday's law; as a conductor moves through a magnetic field an electric potential is generated. In this case the conductor is the animal moving through a magnetic field, and the potential induced depends on the time varying rate of flux through the conductor according to

These organs detect very small fluctuations in the potential difference between the pore and the base of the electroreceptor sack. An increase in potential results in a decrease in the rate of nerve activity, and a decrease in potential results in an increase in the rate of nerve activity. This is analogous to the behavior of a current carrying conductor; with a fixed channel resistance, an increase in potential would decrease the amount of current detected, and vice versa. These receptors are located along the mouth and nose of sharks and stingrays.

In invertebrates

The mollusc Tritonia diomeda has been studied for clues as to the neural mechanism behind magnetoreception in a species. ***Tritonia diomedea*** is a species of dendronotid nudibranch.It is a marine gastropod mollusc in thefamily Tritoniidae.Some of the earliest work with Tritonia showed that prior to a full moon Tritonia would orient their bodies between magnetic north and east. A Y-maze was established with a right turn equal to geomag-netic south and a left turn equal to geomagnetic east. Within this geomagnetic field 80% of Tritonia made a turn to the left or magnetic east. However, when a reversed magnetic field was applied that rotated magnetic north 180° there was no significant preference for either turn, which now corresponded with magnetic north and magnetic west. These results, though interesting, do not conclusively establish that Tritonia uses magnetic fields in magnetoreception. These experiments do not include a control for the activation of the Rubens' coil in the reversed magnetic field experiments. Therefore, it is possible that heat or noise generated by the coil was responsible for the loss of choice preference. Future work with Tritonia was unable to identify any neurons that showed rapid changes in firing as a result of magnetic fields.However, pedal 5 neurons, two bisymmetric neurons located within the Tritonia pedal ganglion, exhibited gradual changes in firing over time following 30 minutes of magnetic stimulation provided by a Rubens' coil. Further studies showed that pedal 7 neurons in the pedal ganglion were

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inhibited when exposed to magnetic fields over the course of 30 minutes. The function of both pedal 5 neurons and pedal 7 neurons is currently unknown.

Tritonia diomedea.

Drosophila melanogaster has been another invertebrate in which it has been suggested that orientation in response to magnetic fields is possible. ***Drosophila melanogaster*** is a species of Diptera, or the order of flies, in the familyDrosophilidae. The species is known generally as the **common fruit fly** or **vinegar fly**. Starting from Charles W. Woodworth, this species is a model organism that is widely used for biological research in studies of genetics, physiology, microbial pathogenesis and life history evolution. It is typically used because it is a species that is easy to care for, breeds quickly, and lays many eggs. Recently, precise experimental techniques such as gene knockouts have allowed a closer examination of possible magnetoreception in Drosophila. Various Drosophila strains have been trained to respond to magnetic fields. In a choice test flies were loaded into an apparatus with two arms that were surrounded by electric coils. Current was run through each of the coils, but only one would a 5 Gauss magnetic field at a time. The flies in this T-maze were tested on their native ability to recognize the presence of the magnetic field in an arm and on their response following training where the magnetic field was paired with a sucrose reward. Many of the strains of flies showed a learned preference for the magnetic field following training. However, when the only cryptochrome found in Drosophila, type 1 Cry, is altered, either through a missense mutation or replacement of the Cry gene, the flies exhibit a loss of magnetosensitivity. Furthermore, when light is filtered to only allow wavelengths greater than 420 nm through, Drosophila loses its trained response to magnetic fields. This response to filtered light is likely linked to the action spectrum of fly-cryptochrome which has a range from 350 nm – 400 nm and plateaus from 430-450 nm. Although it had previously been believed that a tryptophan triad in cryptochrome was responsible for the free radicals on which magnetic fields could act, recent work with Drosophila has shown that tryptophan might not be behind cryptochrome dependent magnetoreception. Alteration of the tryptophan protein does not result in the loss of magnetosensitivity of a fly expressing either type 1 Cry or the cryptochrome found in vertebrates, type 2 Cry Therefore it remains unclear exactly how cryptochrome mediates magnetoreception. It is also important to note that in these experiments a 5 gauss magnetic field is used which is 10 times the strength of the Earth's magnetic field). Drosophila have not yet been shown to respond to magnetic fields with the same strength as the Earth's field.

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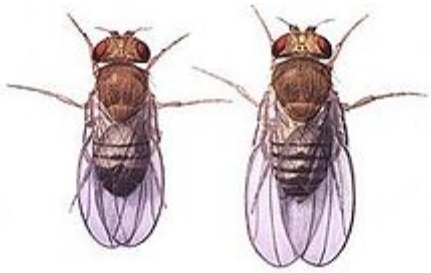

Male *Drosophila melanogaster*
Male (left) and female *D. melanogaster*

homing pigeons

Homing pigeons have been known to use magnetic fields as part of their complex navigation system. Homing system pigeons use the Earth's magnetic field to navigate their way home over long distances, scientists writing in Nature magazine claim. The pigeons probably use tiny magnetic particles in their beaks to sense our planet's magnetic field, scientists say The birds use their ability to create a map of this field and then use it to navigate back to their home loft, New Zealand researchers claim.

Work by William Keeton showed that homing pigeons that were time shifted were unable to orient themselves correctly on a clear sunny day. This was considered a result of the fact that homing pigeons who used the sun for navigation would have to compensate for its movement throughout the day and a time shifted pigeon would be incapable of doing such compensation properly. However, if time shifted pigeons were released on overcast day they navigated correctly. This led to the hypothesis that under particular conditions homing pigeons rely on magnetic fields to orient themselves. Further experiments with magnets attached to the backs of homing pigeons demonstrated that disruption of the bird's ability to sense the Earth's magnetic field leads to a loss of proper orientation behavior under overcast conditions. There have been two mechanisms implicated in homing pigeon magnetoreception : the visually mediated free-radical pair mechanism and a magnetite based directional compass or inclination compass. More recent behavioral tests have shown that pigeons are able to detect magnetic anomalies of 186 microtesla.[18] In a choice test birds were trained to jump on to a platform on one end of a tunnel if there was no magnetic field present and to jump on to a platform on the other end of the tunnel if a magnetic field was present. In this test, birds were rewarded with a food prize and punished with a time penalty. Homing pigeons were able to make the correct choice 55%-65% of the time which is higher than what would be expected if the pigeons were simply guessing. The ability of pigeons to detect a magnetic field is impaired by application of ligocaine, an anesthetic, to the olfactory mucosa. Furthermore, sectioning the trigeminal nerve leads to an inability to detect a magnetic field, while sectioning of the olfactory nerve has no effect on the magnetic sense of homing pigeons. These results suggest that magnetite located in the beak of pigeons may be responsible for magnetoreception via trigeminal mediation. However, it has not been shown that the magnetite located in the beak of pigeons is capable of responding to a magnetic field with the Earth's strength. Therefore the receptor responsible for magnetosensitivity in homing pigeons has not been cemented. Aside from the sensory receptor for magnetic reception in homing pigeons there has been work on neural regions that are possibly involved in the processing of magnetic information within the brain. Areas of the brain that have shown increases in activity in response to magnetic fields with a strength of 50 or 150 microtesla are the posterior vestibular nuclei, dorsal thalamus, hippocampus, and visual hyperpallium. As

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previously mentioned pigeons provided some of the first evidence for the use of magnetoreception in navigation. As a result, they have been an organism of focus in magnetoreception studies. The precise mechanism used by pigeons has not been established and so it is as of yet unclear whether pigeons rely solely on a cryptochrome-mediated receptor or on beak-magnetite.

:**Homing pigeon**

In mammals

Work with mice, mole rats, and bats has shown that some mammals may be capable of magnetoception. When woodmice are removed from their home area and deprived of visual and olfactory cues they seem to orient themselves correctly towards their homes until an inverted magnetic field is applied to their cage. When the same mice are allowed access to visual cues however they demonstrate the ability to orient themselves towards home, despite the presence of inverted magnetic fields. This seems to suggest that woodmice use magnetic fields to orient themselves when displaced if there are no other cues available. However studies such as this have been criticized because of the difficulty of completely removing sensory cues and the fact that while some of these studies are done the magnetic field is artificially changed before the test as opposed to during the test. Due to the timing of the magnetic fields activation the results of these experiments do not conclusively show that woodmice respond to magnetic fields when deprived of other cues. Work with the Zambian mole rat, a subterranean mammal, has led to reports that they use magnetic fields as a polarity compass to aid in the orientation of their nests. In contrast to work with woodmice, Zambian mole rats do not exhibit different orientation behavior when a visual cue such as the sun is present, a result that has been suggested is due to their subterranean lifestyle. Further investigation of mole rat magnetoreception lead to the finding that exposure to magnetic fields leads to an increase in neural activity within the superior colliculus as measured by immediate early gene expression. The activity level of neurons within two levels of the superior colliculus, the outer sublayer of the intermediate gray layer and the deep gray layer, were elevated in a non-specific manner when exposed to various magnetic fields. However, within the inner sublayer of the intermediate gray layer (InGi) there were two or three clusters of responsive cells. The more time the mole rats were exposed to a magnetic field the greater the immediate early gene expression within the InGi. However, if Zambiam mole rats were placed in a field with a shielded magnetic field only a few scattered cells were active. Therefore it has been proposed that in mammals the superior colliculus is an important neural structure in the processing of magnetic information.

The **Big Brown Bat** (*Eptesicus fuscus*) is larger in size than comparative species of bats, from about 4 to 5 inches (10 – 13 cm) in body length, with a 11-13 inch (28 to 33 cm) wingspan and weighing 1/2 to 5/8 ounce. The fur is moderately long, and shiny brown. The wing membranes, ears, feet, and face are dark brown to blackish in color. Big brown bats are nocturnal, roosting during the day in hollow trees, beneath loose tree bark, in the crevices of rocks or in man-made structures such as attics, barns, old buildings, eaves and window shutters. Big brown bats navigate through the night skies by use of echolocation, producing ultrasonic sounds through the mouth or nose. Big brown bats are known also to produce audible sound during flight. Its voice is a click or a sound like escaping steam. Bats also seem to utilize magnetic fields in orienting

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themselves. While bats have been known to utilize echolocation to undergo navigation over short-distances it is unclear what they use to navigate over longer distances.When Eptisecus fuscus are taken from their home roosts and exposed to magnetic fields 90 degreees clockwise or counterclockwise of magnetic north, they are disoriented and set off for their homes in the wrong direction. Therefore, it seems that Eptisecus fuscus is capable of magnetosensation. However, the exact use of magnetic fields in Eptisecus fuscus is unclear as it is possible that the magnetic field is used as a map, compass, or compass calibrator. Recent work with another bat species, Myotis myotis, has lent credence to the idea that bats use magnetic fields as a compass calibrator, and their primary compass is the sun.

Big Brown Bat

Issues

Clearly the largest issue affecting verification of an animal magnetic sense is that despite more than 40 years of work on magnetoreception there has yet to be an identification of a sensory receptor. In various organisms a cryptochrome mediated receptor has been implicated in magnetoreception. At the same time a magnetite system has been found to be relevant to magnetosensation in birds. Furthermore, it is possible that both of these mechanisms play a role in magnetic field detection in animals. This dual mechanism theory has been proposed in birds and the question that arises, if such a mechanism is actually responsible for magnetoception, is to what degree each method is responsible for stimuli transduction. Regardless of the importance of either of these mechanisms, an issue they must both address is how they lead to a tranducible signal given a magnetic field with the Earth's strength. The precise purpose of magnetoreception in animal navigation is also unclear. There is evidence that some animals may be using their magnetic sense as either a map, compass, or compass calibrator. For example birds such as the homing pigeon are believed to use the magnetite in their beaks to detect magnetic sign posts and thus, the magnetic sense they gain from this pathway is a possible map.Yet, it has also been suggested that homing pigeons and other birds use the visually mediated cryptochrome receptor as a compass. The purpose of magnetoreception in birds and other animals may be varied, but work to conclusively establish which aspect of navigation in particular such a sense is used for is often difficult to conduct.

There are also a number of experimental concerns that are difficult to disentangle from the results of much of the research. An example of this difficulty has been reflected in the fact that numerous studies use magnetic fields that are larger than the Earth's field. As a result of the lack of studies using ambient magnetic fields with the same strength as those of the Earth the relevance of magnetoreception for animals has not been conclusively proven. Furthermore, in many studies such as those done with Tritonia electrophysiological recordings have been done with only one or two neurons. The scale of these experiments is not particularly large. In addition many of the studies on magnetoreception have been solely correlational.

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Future Directions

The discovery of a sensory receptor for magnetoreception is clearly the foremost issue in this field at the moment. The establishment of Drosophila as an organism of interest has allowed for genetic techniques to be used that have already led to serious results on magnetoreception. As more manipulative studies involving nerve lesioning and genetic manipulation occur, serious advances in our knowledge of magnetoreception should occur. Due to the length of time that has elapsed since magnetoreception was first suggested and today, clarification of its purpose and mechanism in animals will probably require multidimensional analysis integrating the work of neurologists, ethologists, geneticists, and physicists among other scientists.

Self-assembly

Self-assembly is the most common term in use in the modern scientific community to describe the spontaneous aggregation of particles (atoms, molecules, colloids, micelles, etc.) without the influence of any external forces. Large groups of such particles are known to assemble themselves into thermodynamically stable, structurally well-defined arrays, quite reminiscent of one of the 7 crystal systems found in metallurgy and mineralogy (e.g. face-centered cubic, body-centered cubic, etc.). The fundamental difference in equilibrium structure is in the spatial scale of the unit cell (or lattice parameter) in each particular case. Molecular self-assembly is found widely in biological systems and provides the basis of a wide variety of complex biological structures. This includes an emerging class of mechanically superior biomaterials based on microstructural features and designs found in nature. Thus, self-assembly is also emerging as a new strategy in chemical synthesis and nanotechnology. Molecular crystals, liquid crystals, colloids, micelles, emulsions, phase-separated polymers, thin films and self-assembled monolayers all represent examples of the types of highly ordered structures which are obtained using these techniques. The distinguishing feature of these methods is self-organization.

Structural hierarchy

Nearly all materials could be seen as hierarchically structured, especially since the changes in spatial scale bring about different mechanisms of deformation and damage. However, in biological materials this hierarchical organization is inherent to the microstructure. One of the first examples of this, in the history of structural biology, is the early X-Ray scattering work on the hierarchical structure of hair and wool by Astbury and Woods. In bone, for example, collagen is the building block of the organic matrix—a triple helix with diameter of 1.5 nm. **Collagen** is a group of naturally occurring proteins found in animals, especially in the flesh and connective tissues of mammals. It is the main component of connective tissue, and is the most abundant protein in mammals, making up about 25% to 35% of the whole-body protein content. Collagen, in the form of elongated fibrils, is mostly found in fibrous tissues such as tendon, ligament and skin, and is also abundant in cornea, cartilage, bone, blood vessels, the gut, and intervertebral disc. The fibroblast is the most common cell which creates collagen. In muscle tissue, it serves as a major component of the endomysium. Collagen constitutes one to two percent of muscle tissue, and accounts for 6% of the weight of strong, tendinous muscles. Gelatin, which is used in food and industry, is collagen that has been irreversibly hydrolyzed. These tropocollagen molecules are intercalated with the mineral phase (hydroxyapatite, a calcium phosphate) forming fibrils that curl into helicoids of alternating directions. These "osteons" are the basic building blocks of bones, with the volume fraction distribution between organic and mineral phase being about 60/40. In another level of complexity, the hydroxyapatite crystals are platelets that have a diameter of approximately 70–100 nm and thickness of 1 nm. They originally nucleate at the gaps between collagen fibrils. Similarly, the hierarchy of abalone shell begins at the nano level, with an organic layer having a thickness of 20–30 nm. This layer proceeds with single crystals of aragonite (a polymorph of $CaCO_3$)

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consisting of "bricks" with dimensions of 0.5 and finishing with layers approximately 0.3 mm (mesostructure). Crabs are arthropods whose carapace is made of a mineralized hard component (which exhibits brittle fracture) and a softer organic component composed primarily of chitin. The brittle component is arranged in a helical pattern. Each of these mineral 'rods' (1 µm diameter) contains chitin–protein fibrils with approximately 60 nm diameter. These fibrils are made of 3 nm diameter canals which link the interior and exterior of the shell.

Biomaterials are used in:

- Joint replacements
- Bone plates
- Bone cement
- Artificial ligaments and tendons
- Dental implants for tooth fixation
- Blood vessel prostheses
- Heart valves
- Skin repair devices (artificial tissue)
- Cochlear replacements
- Contact lenses
- Breast implants
- Biomaterials must be compatible with the body, and there are often issues of biocompatibility which must be resolved before a product can be placed on the market and used in a clinical setting. Because of this, biomaterials are usually subjected to the same requirements as those undergone by new drug therapies.All manufacturing companies are also required to ensure trace ability of all of their products so that if a defective product is discovered, others in the same batch may be traced.

Heart valves

In the United States, 45% of the 250,000 valve replacement procedures performed annually involve a mechanical valve implant. The most widely used valve is a bileaflet disc heart valve, or St. Jude valve. The mechanics involve two semicircular discs moving back and forth, with both allowing the flow of blood as well as the ability to form a seal against backflow. The valve is coated with pyrolytic carbon, and secured to the surrounding tissue with a mesh of woven fabric called Dacron™ (du Pont's trade name for polyethylene terephthalate). The mesh allows for the body's tissue to grow while incorporating the valve. Most of the time "artificial" tissue is grown from the patients own cells. However, when the damage is so extreme that it is impossible to use the patient's own cells, artificial tissue cells are grown. The difficulty is in finding a scaffold that the cells can grow and organize on. The characteristics of the scaffold must be that it is biocompatible, cells can adhere to the scaffold, mechanically strong and biodegradable. One successful scaffold is a copolymer of lactic acid and glycolic acid.

Compatibility

Biocompatibility is related to the behavior of biomaterials in various environments under various chemical and physical conditions. The term may refer to specific properties of a material without specifying where or how the material is to be used. For example, a material may elicit little or no immune response in a given organism, and may or may not able to integrate with a particular cell type or tissue). The ambiguity of the term reflects the ongoing development of insights into how biomaterials interact with the human body and eventually how those interactions determine the clinical success of a medical device (such as pacemaker or hip replacement). Modern medical devices and prostheses are often made of more than one material—so it might not always be sufficient to talk about the biocompatibility of a specific material.

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A **pacemaker** (or **artificial pacemaker**, so as not to be confused with the heart's natural pacemaker) is a medical device that uses electrical impulses, delivered by electrodes contacting the heart muscles, to regulate the beating of the heart. The primary purpose of a pacemaker is to maintain an adequate heart rate, either because of the heart's native pacemaker is not fast enough, or there is a block in the heart's electrical conduction system. Modern pacemakers are externally programmable and allow the cardiologist to select the optimum pacing modes for individual patients. Some combine a pacemaker and defibrillator in a single implantable device. Others have multiple electrodes stimulating differing positions within the heart to improve synchronisation of the lower chambers of the heart.

Hip replacement is a surgical procedure in which the hip joint is replaced by a prosthetic implant. Hip replacement surgery can be performed as a total replacement or a hemi (half) replacement. Such joint replacement orthopaedic surgery is generally conducted to relieve arthritis pain or fix severe physical joint damage as part of hip fracture treatment. A total hip replacement (total hip arthroplasty) consists of replacing both the acetabulum and the femoral head while hemi arthroplasty generally only replaces the femoral head. Hip replacement is currently the most common orthopaedic operation, though patient satisfaction short and long term varies widely.

Peace Maker

Hip Transplant

Biopolymers

Biopolymers are polymers produced by living organisms. Cellulose and starch, proteins and peptides, and DNA and RNA are all examples of biopolymers, in which the monomeric units, respectively, are sugars, amino acid, and nucleotides. Cellulose is both the most common biopolymer and the most common organic compound on Earth. About 33% of all plant matter is cellulose. Some biopolymers are biodegradable. That is, they are broken down into CO_2 and water by microorganisms. In addition, some of these biodegradable biopolymers are compostable. That is, they can be put into an industrial composting process and will break down by 90% within 6 months. Biopolymers that do this

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can be marked with a 'compostable' symbol, under European Standard EN 13432 (2000). Packaging marked with this symbol can be put into industrial composting processes and will break down within 6 months (or less). An example of a compostable polymer is PLA film under 20 µm thick: films which are thicker than that do not qualify as compostable, even though they are biodegradable. A home composting logo may soon be established: this will enable consumers to dispose of packaging directly onto their own compost heap.

Tissue engineering

Tissue engineering is the use of a combination of cells, engineering and materials methods, and suitable biochemical and physio-chemical factors to improve or replace biological functions. While it was once categorized as a sub-field of bio materials, having grown in scope and importance it can be considered as a field in its own right. While most definitions of tissue engineering cover a broad range of applications, in practice the term is closely associated with applications that repair or replace portions of or whole tissues (i.e., bone, cartilage, blood vessels, bladder, skin etc.). Often, the tissues involved require certain mechanical and structural properties for proper functioning. The term has also been applied to efforts to perform specific biochemical functions using cells within an artificially-created support system (e.g. an artificial pancreas, or a bio artificial liver). The term *regenerative medicine* is often used synonymously with tissue engineering, although those involved in regenerative medicine place more emphasis on the use of stem cells to produce tissues.

Artificial skin (Skin repair)

Artificial skin can refer to skin grown in a laboratory that can be used as skin replacement for people who have suffered skin trauma such as severe burns or skin diseases. Alternatively, it can also refer to skin synthetically produced for other purposes. The skin is the largest organ in the human body. Severe damage to large areas of skin exposes the human organism to dehydration and infections that can result in death. Traditional ways of dealing with large losses of skin have been to use skin from other parts of a patient's body (such the thigh) or from a different person/cadaver. The former approach has the disadvantage that there may not be enough skin available, while the latter suffers from the possibility of rejection or infection. To solve these issues, research is being done on artificial skin. Typically, a collagen scaffold is used (the protein that underlies the structure of skin), which can be additionally seeded with patient's own cells,or with foreskin from newborns that was removed during circumcision. Cells are often implanted or 'seeded' into an artificial structure capable of supporting three-dimensional tissue formation. These structures, typically called scaffolds.. Scaffolds usually serve at least one of the following purposes:

- Allow cell attachment and migration
- Deliver and retain cells and biochemical factors
- Enable diffusion of vital cell nutrients and expressed products
- Exert certain mechanical and biological influences to modify the behaviour of the cell phase

Additional technologies, such as an autologous spray-on skin produced by Avita Medical, are being tested in efforts to accelerate healing and minimize scarring.The Fraunhofer Institute for Interfacial Engineering and Biotechnology is working towards a fully automated process for producing artificial skin. Their goal is a simple two-layer skin without blood vessels that can be used to study how skin interacts with consumer products, such as creams and medicines. They hope to eventually produce more complex skin that can be used in transplants A form of “artificial skin” has been demonstrated

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which is created out of flexible semiconductor materials that can sense touch. The artificial skin is anticipated to augment robotics in conducting rudimentary jobs that would be considered delicate and require "touch". It is also expected that the technology can be further advanced to be used on prosthetic limbs to restore a sense of touch.

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Dr.Ambedker's economic philosophy in India

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ABSTRACT
The contributions of Dr.B.R.Ambedkar pervade the entire gamut of social sciences. Therefore his legacies to knowledge make him to socialist, historian, economist, political thinker and strategist, law maker and cultural revolutionary. Dr. Ambedkar has tried to strengthen Indian economy by providing solution to the Indian economic problems. Many decades ago, India liberated itself from the shackles of socialism and a command economy and put itself on the road to a liberal economic system. According to him, the caste system divided labours and it was one of the hurdles for the economic progress. He emphasised on free economy with stable rupee which India has adopted recently. He advocated the birth control rate to develop the Indian economy. This policy has been adopted by Indian government as national policy for family planning. He emphasised on equal rights to women for economic development.He laid the foundation of industrial relations after Indian independence. In the process of the fittest of the survival, the poor and working classes can suffer more. Dr. Ambedkar's state socialism aimed to strengthen weaker sections to face the challenges of globalization. The Problem of the Rupee was Ambedkar's magnum opus, in which he emphasized the need for a sound monetary system. He opined that India needed to help people migrate from agriculture to industry. Dr. B. R. Ambedkar advocated that overpopulation leads to poverty and on the women health side, it is harmful. Dr. Ambedkar belived that India's economic development should be based on eradication of property elimination of inequities and ending exploitation of masses. The present research paper is entirely based on secondary data. This paper gives closer and analytical insight into the thoughts and provides an exploration of his economic philosophy for Indian to achieve growth and social justice.

INTRODUCTION

Ambedkar was the first Indian to pursue an Economics doctorate degree abroad. According to him the industrialization and agricultural industry growth could enhance the economy of the nation. He stressed on money investment in the agricultural industry as the primary industry of India. The contributions of Dr.B.R.Ambedkar pervade the entire gamut of social sciences. It would be very difficult and at times even meaningless to classify his contributions as economic, sociological, political and cultural with regard to multi-disciplinary nature of his thought-process. Dr. Ambedkar has tried to strengthen Indian economy by providing solution to the Indian economic problems such as problems in the development of agriculture, industries as well as education. Decades ago, India liberated itself from the shackles of socialism and a command economy and put itself on the road to a liberal economic system. Dr. Ambedkar's economic ideas are more relevant in the age of globalization. His ideas on economics are relevant today as ever before and in dire need of revival. Ambedkar, before becoming a social reformer and entering politics full time, was a professional practicing economist — a little known fact. But in post-independent India, virtually all of his insightful and powerful economic ideas and writings

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have been forgotten and neglected, both by Indian intellectuals in general and economic historians and Ambedkarites in particular.

Ambedker's economic philosophy is expressed in his ideas on mixed economy socialism, state ownership of industries, industrialization, etc. he belongs to group of liberal thinkers but by and large his orientation is that of a socialist. His economic ideas reflected his concern for the social ladder. In order to eradication by landlords and capitalist he advised mixed economy or state socialism. Despite this, twentieth century India produced many great classical liberal economists and thinkers who pioneered original free market economic ideas if this comes as a surprise to you, read on. Dr. B.R Ambedkar, best known for his role in drafting India's constitution, pioneered several path breaking free market economic ideas in pre-independent India, scrubbed out of our conscience today. Take Anand Teltumbde, Dalit activist and management professor, who argued in an article that "Ambedkar, who publicly professed his opposition to capitalism throughout his life, was thus willfully distorted to be the supporter of neoliberal capitalism, which globalization is!" In fact, in pre-independent India the one economist whose ideas were global in perspective and close to the Austrian School of Economics (pre-cursor of modern libertarian economics) was none other than Ambedkar.

To provide an exploration of economic ideas of Babasaheb Ambedkar with a view of delineate a place for him as an economic reformer in Indian philosophy. Paper tries to explore major themes that Ambedkar concerned himself in his professional writings. The present research paper is entirely based on secondary data. While preparing the research paper various references like; research journals, books, contemporary writings and speeches of Dr. B. R. Ambedkar published by the Government and published research papers have been used.

2. So what was Ambedkar's contribution to economics?

Ambedkar wrote extensively on finance, monetary economics, banking systems, and interstate financial relations. He had expertise on Indian currency and banking in the second half of the 19th century and the early decades of the 20th century. He was trained under great scholars like Edwin Cannan, Edwin Seligman, John Dewey, James Robinson, and James Shotwell. A keen student of economics, Ambedkar was an advocate for private property rights, the gold standard, "free banking" or multiple competing currencies, and decentralized planning. Always a champion of individual liberty and freedom, he was a vehement critic of Maynard Keynes, and his views were much more in consonance with the great architect of libertarian thought, Hayek.

2.1. Firstly, ***The Problem of the Rupee*** was Ambedkar's magnum opus, in which he emphasized the need for a sound monetary system for trade and its nexus with private property rights. In the book, he focused attention on the currency crisis, i.e. the pure gold standard. Writing in the first chapter (1947: 1-2) he writes:

"Trade is an important apparatus in a society, based on private property and pursuit of individual gain; without it, it would be difficult for its members to distribute the specialized products of their labour…With money as the focusing-point of all human efforts, interests, desires, and ambitions, a trading society is bound to function in a regime of price, where successes and failures are results of nice calculations of price-outlay as against price-product."

If Ambedkar were alive today, it's evident where he would stand on the "Sen-Bhagwati debate" — firmly on the side of free markets and not redistributive, socialist welfare schemes. Many thinkers pointed out in a 2001 speech on Ambedkar's contributions to Indian economics. In his statement to the royal commission on the rupee, Ambedkar defined the controversy in a way that is relevant today as well: "At the outset, it is necessary to realize that this controversy involves two distinct questions: (i) Should we stabilize our exchange and (ii) What should be the ratio at which we should stabilize?" The current context is very different, but the way Ambedkar framed the problem is still relevant today: Should the Reserve Bank of India try to defend the rupee and what value should it defend? Ambedkar eventually argued in favour of a limited devaluation of the rupee, somewhere between the exchange rates that the two competing groups were in favour of: the colonial government representing British

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business interests that wanted to maintain the existing exchange rate and the Congress speaking for Indian business interests that wanted a cheaper rupee. A cheaper rupee at the end of the 19th century had helped Indian exporters. His reasoning for such a compromise settlement was fascinating, because it looked at the distributional consequences of exchange rate management. Ambedkar said that a limited devaluation would help the business class as well as the earning class. A very steep devaluation would harm the latter since they would be hit by high inflation if the fall in the rupee was too steep. In effect, he said that the interests of these two groups should be balanced while thinking of the value of the rupee, because a very steep devaluation would reduce real wages of the earning class because of inflation. Ambedkar was clearly in favour of price stability and automatic monetary management (or what may today be termed as rule-based monetary policy). Much has changed in the Indian economy since Ambedkar did his academic work in monetary economics. But some of his general approach to the problem of the rupee is still relevant: the benefits of depreciation in an open economy, the need to take the distributional consequences into account, the need to maintain price stability in the domestic economy, and the preference for rules over discretion in monetary management. Ambedkar was very much an economist of his time, firmly wedded to the quantity theory of money and the gold standard.

If Ambedkar's words had been heeded in the last few years, they might have helped avoid the global financial crisis. More specifically this is as an important contribution to the discussion of currency problems in India or elsewhere for that matter. These ideas are also core beliefs of the Austrian School of Economics, exemplified by Carl Menger whose work was familiar to Ambedkar. However, Ambedkar articulated the idea of multiple or competing currencies inspired by the works of the great liberal thinker, Gopal Krishna Gokhale, who wrote independently of the Austrians.

2.2. The second and third of these works contain many ***pro-market ideas*** which were hardly known then but later gained currency in the second half of the twentieth century. What's more, through his writings Ambedkar pioneered original ideas like "economic and political decision making in an environment of dispersed knowledge" and "alternative monetary systems (and the) denationalized production of money", the sort of ideas that one might have found in the writings of the great Austrian economist, Friedrich von Hayek, but which were virtually unknown in India and Britain at the time.

In one of his earliest scholarly papers, from 1918, ***Ambedkar opined that India needed to help people migrate from agriculture to industry*** "A large agricultural population with the lowest proportion of land in actual cultivation means that a large part of the agricultural population is superfluous and idle…this labour when productively employed will cease to live by predation as it does today, and will not only earn its keep but will give us surplus; and more surplus means more capital. In short, strange as it may seem, industrialization of India is the soundest remedy for the agricultural problems of India." His views too changed as the years went by, and as he moved closer to socialism. It is unfortunate that he almost abandoned economics after the mid-1920s, though an early paper published in 1918 on the problem of small holdings in Indian agriculture is almost prophetic in its anticipation of several themes in later development economics, including the existence of disguised unemployment in farming. He showed why India needs to industrialize to absorb this surplus labour. His sole purpose was eradication of Indian poverty, which is due to problems and weaknesses of Indian agriculture. Dr. Ambedkar pointed that "Nothing can open possibilities of making agriculture in India profitable except a serious drive in favor of industrialization." This is still relevant today and would be great advice to the government on why we need to reduce surplus non-productive employment in agriculture.

In light of all of this, it's evident that, as an economist, Ambedkar **was *closer to free-market economics*** and no advocate of socialism or Marxism, as he is often painted by his dubious followers who would gladly erase this important facet of their icon's legacy. Ambedkar‟s conclusion is clearly towards price stability through conservative and automatic monetary management. This is of such current

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relevance that in these days of burgeoning budget deficits and their automatic monetization, it would appear that we could do with an effective restraint on liquidity creation through an automatic mechanism.

2.3. The Contemporary relevance of Dr. Ambedkar's ***contribution to public finance*** is that first of all it is a poineering work. It has been the guiding spirit behind the reports of the successive Finance commissions in Independent India. The credit for establishment of the Finance commission and the R.B.I. goes to Dr. Ambedkar's views. He was opposed to Land Revenue its system and other taxes as their burden fell heavily on the poorer section of the society. He enunciated the principles of taxation as following: (a) Tax Should be imposed according to the payer's capacity and not on income. (b) The Tax should be progressive being less on the poor and more on the rich. (c) Tax exemption should be given up to certain limit. (d) The land revenue tax should be more flexible. (e) There should be equality between different sections in tax imposition. (f) The tax should not lead to lowering of standard of living of the people. Dr. Ambedkar suggested that *land Revenue Tax should be progressive*. Ambedkar's canon of public expenditure is ism-neutral. The canons emphasize that the expenditure decisions should closely relate to the specified objectives and the available resources besides ensuring economy, efficiency and effectiveness in the implementation of government decisions. Indeed, it was Ambedkar who strongly opposed inserting the word "***socialism***" in the preamble of the Indian Constitution. Would he do this if he supported Marxist economics?

2.4. According to Seligman his guide and world famous economist" it is objective recitation of facts and *impartial analysis of the centre - state relationship* in British India". It has a great historical significance. Second and more importantly it provides groundwork for ***centre - state relationship in modern India***. Key industries shall be owned and run by the state. Basic but non-key industries shall be owned by the state and run by the state or by corporations established by it. Agriculture shall be a state industry, and be organized by the state taking over all land and letting it out for cultivation in suitable standard sizes to residents of villages; these shall be cultivated as collective farms by groups of families. He also stresses the need for industrialization so as to move surplus labour from agriculture to other productive occupations, accompanied by large capital investments in agriculture to raise yields. He sees an extremely important role for the state in such transformation of agriculture and advocates the nationalization of land and the leasing out of land to groups of cultivators, who are to be encouraged to form cooperatives in order to promote agriculture. As remedies to solve real problem off agriculture Dr. Ambedkar Suggested(1)co-operative or collective farming. (2) Economic holdings (3) Transfer of surplus labour from agriculture to industry (4) Provision of other sources of production (5) Large Scale industrialization (6) Natuionalisation of agriculture (7) Provision of money water seeds and fertilizers by government (8) Abolition of "Khoti System in Agriculture". (9)Cultivation of waste land under Cultivation which should be allotted to the landless labour. (10) Application of minimum wages to agriculture labour. (11) Protection to tenents and tillers (12) Increasing supply of capital funds to agriculture (13) Control of and regulation of private money lenders, pass book to every debtor with entries of loan.

Dr. Ambedkar belived that India's economic development should be based on *eradication of property elimination of inequities* and *ending exploitation of masses*. He accepted Marxian view in this respect. Yet did not favour the Marxian paradigm of development. Dr. Ambedkar views on communism are presented in his essay "Buddhism and communism" Unlike Marx he did not accept economic relationship as the be-all and end-all of human life. Dr. Ambedkar Presented to the constitution committee a dissertation namely "States and minorities" in which was included his Democratic State Socialism the main points of it may be summarized as 1) All basic industries should be own and run by state. 2) Insurance and agriculture should be nationalized and managed by the state. 3) Maintenance of Productive resources by state. 4) Just Distribution of Common produce. 5) Provision

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for compensation of land or industry acquisition in the form of bonds. 6) The distribution of village and among the families in a village for collective farming. 7) No discrimination as landlord, tenants and agriculture labour. 8) All agriculture input like capital, seeds fertilizers etc would be provided to collective farming by the government. 9) Distribution of agriculture income only after payment of land revenue tax. 10) Punishment according to rules who do not follow the rules.

Over-population is hurdle in the socio-economic development of India. Dr. B. R. Ambedkar advocated that overpopulation leads to poverty and on the women health side, it is harmful. In order to improve women health and reduce poverty and unemployment population control is essential. He was confident that birth control through family planning is the only remedy to solve the problem of overpopulation. It is the prime duty of the government to supply birth control instruments and to make the common man aware, trouble free for the utilization of such instruments through proper education and training. He urged that birth control measures must be safe and for that there is a need of nonstop research. For the sustainable development of the Indian economy population must be controlled with ample tools of family planning.

Dr. Ambedkar denounced the Indian economy as Hindu dominated economy in which Hindu religion is the end and individual its means. He came out with hard hitting critique of this Hindu economy He showed logical flaws in it. Caste System is not merely the division of labour but a division of laboures also. It is not based on natural aptitudes or skills. It is a major obstacle to economic development. It reduces mobility leading to inefficient production. Un-touchability is worse than slavery. It is a system of exploitation. It may be observed that reservation of jobs and seats in educational institutions on low caste basis has been accepted as an instrument of social justice to provide equal opportunities for the depressed and backward classes in India. This is an important contribution of Dr.Ambedkar not only for SC‟s but also for the upliftment of other backward classes and women.

Water being the wealth of the people and its distribution being uncertain, the correct approach was not to complain against nature but to conserve water. Dr. Ambedkar thus looked at the problem of flood or excess of water in a different manner and focused more on the brighter and the positive aspects of the water problem. In the establishment of the Central Waterways, Irrigation and Navigation Commission (CWINC) on April, 1945 Dr. Ambedkar and his Department laid down the foundation for a new water policy on the eve of independence preparing the ground for the prosperity of the emerged nation.

3. Conclusion

What can we conclude from this brief foray into the various economic themes with whom Ambedkar was concerned? The value of his conclusions is substantial precisely because his analysis was based on sound empirical and historical foundations. The main Points of Dr. Babasaheb Ambedkar's impact of economic thoughts on the Indian economy may be summed up
as he suggested agricultural and land reforms some of which have been implemented after Independence except nationalization of agriculture. Dr. Ambedkar's contribution to India's currency, public finance and taxation policy is valuable. According to him price stability is more important than exchange rate stability. In his opinion centralization of government finance is a failure due to faulty fiscal policy. He suggested taxation reforms such as tax should be progressive, as per capacity, certain and flexible. Dr. Ambedkar's model of economic development is based on peaceful eradication of poverty, inequalities and exploitation. He was a proponent of free enterprise economy and globalization, recently accepted by the government of India, but he was squally opposed to the Hindu dominated economy - His concepts of family planning uplittment of women and human capital are important contribution to the development of the Indian economy. Dr. Ambedkar was primarly an economist, his achievement in the field was primarly

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overshadowed by his achievement in his field of politics. He was more concerned about the human welfare. Mixed economy was the cornerstone of his philosophy. He was concerned about equitable distribution of wealth. He advocated the modernization of Indian society and economy.

It's clear that there is not a single political party in India, including the "Ambedkariate" parties, which has taken seriously the economic ideas of Ambedkar. It was Ambedkar who famously said "Educate, Agitate, Organise". But it seems that the trend today is for all manner of people to organise movements and start agitating without bothering to educate themselves! It's a great pity that Ambedkar's Dalit followers are apparently unaware of their hero's free market — even libertarian — views on economics and individual liberty and prefer to hold him hostage to a a narrow conception — he as a Dalit leader — that suits their political ends and ideology. Dr. Ambedkar's new vision of state is very much significant for bringing new India. In 2020 India has to make a plan to eradicate poverty from grass root levels.

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