



Color and
Appearance
Division



CAD NEWS

PUBLISHED BY THE COLOR AND APPEARANCE DIVISION OF THE SOCIETY OF PLASTICS ENGINEERS

CHAIRMAN'S MESSAGE

Over this past several weeks, during my weekend shopping trips to the grocery, hardware and drug stores, I have noticed that toilet paper seems to be the 'weapon of choice' used by the big retailers to draw in customers in my area. It seems that every store is offering 'huge discounts' and 'unbeatable deals' on TP. After dragging home the '30 rolls of 2 ply for \$3.99 - limit of 2 per family', I began to see some strong similarities between toilet paper and color. Both toilet paper and color are products that, in theory, human beings should be able to function without. However, in reality, both are necessities that we can't do very well without. Toilet paper comes in many different qualities (*truck stop to 4 layer/triple quilted/extra soft*) as does color (*simple classical azo pigments to complex/patented/FDA/weather-fast/fully dispersed*). The manufacture of toilet paper, like color, is a very complicated process involving multiple manufacturing steps and significant capital investment. Toilet paper is produced from a primary natural resource (trees) while color comes from oil and minerals.

Okay, the analogy between color and toilet paper becomes a bit 'stretched' at this point but bear with me, please as I try to 'clean' this analysis up. The key to this comparison is in the commoditization (*sorry, I could not resist*) of the products. Clearly, in my small market area, the producers and sellers of toilet paper are on a clear road to commoditization. Despite the millions of dollars that the manufacturers spend on television advertising in telling us how special and unique their products are, their retailers are turning their softer, gentler, quilted, high tech products into a simple commodity measured in cents per sheet per ply. In the color business, whether it's the supply of pigments, dyes, masterbatch or concentrate, it sometimes feels like we too spend much of our time devaluing our products and services in a 'race to the lowest' price. We are busy turning our products and services into commodities.

Commodities, in my world of color, are not a good thing. Once the things we produce and sell become commodities, we need fewer buyers, fewer sellers, fewer technicians, fewer suppliers and fewer producers. The wheels of innovation and creativity grind to a halt and our lives become very 'beige'. The mission of your Color and Appearance Division is to 'educate, train, inform and provide networking opportunities' to those involved in 'Coloring the World of Plastics'. Another way of saying the same thing would be simply 'to prevent the commoditization of color'.

Our Color RETEC® this fall in Savannah was very successful in the war against commoditization. A record number of exhibitors displayed new products and attendance numbers, despite the economy, met the goals that had been set. Scott Aumann, the Chair of the Savannah RETEC® did a fantastic job; but of course, Scott had plenty help.

Therefore, I would like to especially thank all of those of you who attended, organized, exhibited, volunteered, and worked at this year's RETEC®. Your efforts in the battle against commoditization are greatly appreciated. Thank you.

Howard Kennedy
CAD Chairperson

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EDITOR'S NOTE



Hope you enjoy this winter issue of our CAD Newsletter. Since it is near the holiday season, I have included a less technical article and more of a general article about color. It is from a National Geographic magazine from a few years ago with some nice pictures.

The CAD has again conducted a successful RETEC® this fall despite the challenging economy. It was held in historic Savannah, GA. Please see the post report on the next page by Scott Aumann, who was in charge of this conference.

Bob Charvat, the CAD's own Fellow of the Society, was the big time winner at the awards luncheon (see page 9). Bob Charvat and Tracy Phillips jointly received the Terry Golding Outstanding Achievement Award for their work in creating a DVD of all the technical papers from CAD RETEC®'s from 1962 through 2007 (see page 13).

Finally, nominations for this spring's CAD Board of Directors elections are rapidly coming to a close. If you are interested in serving on the CAD Board of Directors, please see the announcement on page 7 for nominating yourself, or a colleague.

Enjoy the Holiday Season!

Jamie Przybylski



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SPE Website: www4spe.org
Go to **Technical Groups**>
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**Non-SPE Websites:
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In general, you must be a registered user on these websites to join the SPECAD Group hosted there. These websites are not affiliated with SPE. To find the SPECAD group, go to the Groups directory and search for "SPE Color and Appearance Division". Or, go to www.specad.org home page for a link to the groups on each website.

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<http://groups.myspace.com/specad>

After reflecting on the RETEC® held in Savannah from the 18th to the 20th of October 2009, I sincerely hope that all that participated see it as a success. I believe that the expectations and desires of the many dedicated professionals in attendance were met. I personally want to thank many people for this success, starting with everyone that attended this event in such challenging times. I want to thank a few key people individually. One of the important jobs that went very smoothly, due to the efforts of Bruce "road trip" Mulholland & Howard Kennedy, was registration. They made the process both simple and convenient. A great technical program is always the building block for a great RETEC®, so I would like to thank both Earl Balthazar and Ann Smeltzer for their efforts over the 12 months leading up to the conference. Along with the technical papers, someone has to keep the sessions moving, and the volunteer moderators did a great job. I would like to give my thanks to them. Another successful piece of the RETEC® proceedings was the "New Technology Forum", which was again handled by Sandra Davis. Thanks Sandy for your dedication and work involved in presenting this popular session. I would also like to thank Clariant for their sponsorship.

Another important part of any RETEC® is the recognition of the people and companies that make the CAD a group that continues to show great value for those who renew their membership year after year. The awards luncheon, sponsored by Tronox, was well attended and presented a forum to recognized those individuals and companies that make the CAD one of SPE's most successful Divisions. One of the highlights every year is the awarding of the Terry Golding award and the meaningful stories that go with it. You can read about some of the awards elsewhere in this newsletter. The RETEC® has a history of being a great blend of education and business. This year continued the legacy as the table top area allowed attendees the networking opportunity to meet vendors, customers and peers. The exhibition area had over 60 spaces full of plastics industry displays, thanks to Brian West.

The CAD Board of Directors work very hard throughout the year to find the best geographic locations and hotels for this very important event. I hope the Hyatt hotel, its meeting rooms, guest rooms and exhibition layout exceeded your expectations. We have never found the perfect location, but some are better than others and I believe that Savannah showed itself very well. I believe that the city of Savannah,

that I am proud to call home, provided our group many choices for great entertainment and memorable southern cuisine.

As part of the conference, this year we had the proper kick-off Monday morning with a southern breakfast sponsored by Lansco and for entertainment; "Color Eye Blind" rocked a full house - at the welcome reception from 6pm to 8pm on Sunday night. The RETEC® experience also includes some fun activities showcasing the local area. A golf outing was held on Sunday that provided the golfers with a challenging course and an incredible view of Savannah and the surrounding area. I would like to thank Mark Tyler and Scott Heitzman and all of the golf sponsors for their efforts to make this a great event. Also, for the first time at a RETEC®, a skeet shooting activity was held. It was coordinated by Matthew Gailey and sponsored by EMD Chemicals. I was told that a good time was had by all and a few have asked that we do it again. Finally, the Fun Run continued its tradition at the 2009 RETEC® on Tuesday morning, and I would like to thank Howard Kennedy and Dominion Color for their efforts and sponsorship.

I have thanked a few of the many people and companies that make this event successful every year, bear with me as I have a few more to thank. The sponsors that are necessary to continue to keep RETEC®'s registration fee relatively low are contacted and coerced by Sharyl Reid, who has done a great job for several years. Sharon Ehr provides the signage that keeps everyone informed. Jamie Przybylski and the volunteers from Terra Community College help out where needed and CAD's resident photographer, Joe "golf is a contact sport" Cameron, chronicles the event in pictures that can be seen on the CAD website, as well as this Newsletter.

In closing I would again like to thank everyone that attended or helped to make the 2009 RETEC® in Savannah a great value and success in these difficult times. Hope you enjoyed the RETEC® if you were able to make it to Savannah - I look forward to seeing even more of you in 2010 in Nashville.



Scott Aumann

Scott R. Aumann
RETEC® 2009
Conference Chairman



RETEC®2009 Staff: (bottom row, left to right) Mark Tyler, Scott Heitzman, Brian West, Howard Kennedy, Earl Balthazar, Ann Smeltzer, Tracy Phillips, Sharyl Reid. (top row, left to right) Matthew Gailey, Scott Aumann, Austin Reid, Bruce Mulholland, Sharon Ehr.

ANTEC®2009 WRAP-UP GOLF OUTING

Teams

The kick off golf outing to the 2009 RETEC® was held at The Club at Savannah Harbor in Savannah Georgia. There were a total of 41 golfers who signed up and also showed up for a shot gun start that utilized a different format than golf outings of the past. The front nine holes had a best ball team format where the best score from each team was the team score. The back nine holes went with a scramble or captain's choice format where each team picked which ball to play and played from that spot. Outside of the excessive winds, the course played fair and everyone seemed to have a good time. Prizes were awarded for the team with the lowest net score and for on course events.

The team with the lowest net score and winners of \$25 gift cards was team 9 which consisted of:

Scott Heitzman, Sun Chemical	Kevin Haynes, Sun Chemical
Russ Neuman, Americhem	Jim Tovey, Mayan Pigments

The hole prize winners and \$50 gift cards were as follows:



LONGEST DRIVE ON HOLE #2:
Craig Maxey, Nubiola
CLOSEST TO THE PIN HOLE #8:
Joe Tuttle, Sun Chemical
LONGEST PUTT MADE ON HOLE #9:
Phil Peterson, The Chidley and Peto Co.
LONGEST PUTT MADE ON HOLE #12:
Mike Rasner, Advanced Blending Solutions
CLOSEST TO THE PIN HOLE #15:
Tim Polgar, Novant Chemicals
LONGEST DRIVE ON HOLE #18:
Marty Hasson, Rockwood Pigments

The SPE RETEC®Conference Committee would like to thank the sponsors for their support and also to all the golfers who participated.



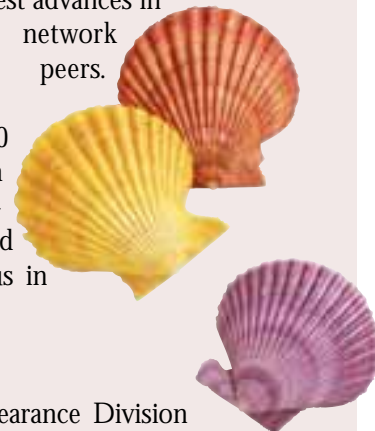
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The Annual Technical Conference (ANTEC™) of the Society of Plastics Engineers is the largest gathering of individuals representing industry, academia and government in the fields of plastics and synthetic

polymers. Engineers, scientists, professors and business professionals attend ANTEC™ to share ideas, to learn about the latest advances in technology and to network amongst their peers.

ANTEC™2010 will take place May 16-20 in Orlando, Florida and we expect excellent attendance and hope you will join us in this experience.



The Color and Appearance Division (CAD) of the Society of Plastics Engineers (SPE) will be hosting our annual technical session during this conference and would like to encourage you and your company to participate by attending the conference. There will be several technical papers presented that will speak to interesting topics in our industry such as color matching, weatherable materials, color trends, new color technology and achieving green color. For more detailed information regarding the conference and for on-line registration, please visit the website www.4spe.org.

Sharyl Reid

ANTEC™ 2010 CAD Technical Program Chair
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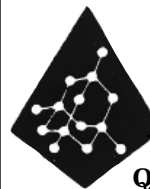
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UPCOMING ELECTION FOR OUR DIVISION

Annual Board Elections. Deadline for Nomination Submissions: December 31, 2009

The Color & Appearance Division of the SPE will be conducting its annual board elections in March 2010. The election is open to SPE members with CAD as their primary division. Time commitment is four meetings per year including those held at ANTEC™ and RETEC®, and participation in CAD activities and initiatives. If you are interested or would like to nominate a colleague, please contact Earl Balthazar at the noted email address or phone before December 31st.

Nominate a Colleague by emailing **Earl Balthazar**, (ebalthazar@tx.rr.com), or call: 1-817-719-0224
Submit your nomination now! (<http://www.4spe.org/forms/color-and-appereance-division-rsvp-form>).

Visit the Color &
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**SPE COLOR & APPEARANCE DIVISION
MISSION STATEMENT**



**Color and
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The Color and Appearance Division of SPE strives to educate, train, inform and to provide professional interaction opportunities to the global community involved in visual performance and aesthetics of plastics.

2010 CAD BOARD ELECTIONS

Director and Councilor Positions ABOUT THE CAD BOARD OF DIRECTORS:

The Board of Directors is the governing body of the CAD Division. The Division Board of Directors is composed of 27 elected Directors, the Council Representative (Councilor), and the 5 Division officers, for a total of 33 positions on the board. SPE CAD is a volunteer organization. Board members are chosen by election.

Members of the Board participate in the planning, organization and running of CAD activities including ANTEC™ programs, RETEC® programs, Technical Programs, Scholarship Programs & Funding, as well as offering guidance and advice to other SPE members interested in coloring plastic resins.

The Councilor provides the Division members a voice in the government of SPE by representing the SPE CAD Division at SPE Council Meetings (minimum 4 meetings per year). The next councilor election will be in 2012.

TERM OF SERVICE FOR THOSE ELECTED:

Each CAD Board Candidate serves a three year term, beginning at the close of ANTEC™ following the election. CAD requires all of its Board Members to actively participate in Board activities including attendance at ANTEC™ and RETEC® and the four planning meetings held annually. This year's nominees are running for a term beginning in 2010 and ending in 2013.

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AWARD OF EXCELLENCE... "IN RECOGNITION OF HIS CONTRIBUTIONS IN THE FIELD OF COLORING OF PLASTICS EDUCATION". ROBERT A. CHARVAT

Robert A. Charvat (Bob) has been extremely active in education within the plastics industry, and most specifically with the technology of the coloring of plastics. In my 28 years within the coloring of plastics industry, I know of no one else who has contributed more to the general education of industry personnel than Bob. Coloring of plastics technology is a combination of art and science, generally learned on-the-job. Because of this, seminars and lectures are extremely important in the education process for individuals in the field of coloring plastics. For many, this is the only classroom type education they receive that provides the fundamentals of this technology. Bob has reached hundreds through his active participation as instructor for color seminars provided by the SPE Seminar Series, seminars at Color & Appearance Division RETEC®s, lectures at SPE Sections, and seminars provided by SPI. Bob not only acts as instructor, but he developed most of the content for these seminars. Publishing the textbook Coloring of Plastics: Fundamentals in 2003 provided Bob a way to reach hundreds more, and continues to serve as a text for courses and a reference guide throughout industry. I know first hand that Bob is currently working on Volume 2, which will address applying those fundamentals to the specific polymers used in our industry.

Bob's most important contribution to education in our industry was his involvement with developing and teaching as part of the Coloring of Plastics Program at Terra Community College. In the mid 1980's, the Color & Appearance Division saw that the demand for qualified color development specialists was increasing, but there was no place to develop this talent within academia. As mentioned above, these specialists generally are hired with no experience or background in color or plastics, and have to learn on-the-job which not only takes significant time and resources for the company, but slows the individual's ability to contribute. My experience tells me that it takes about five years to develop a good color technologist using this approach.

The CAD decided to address this problem by partnering with a school to develop a two-year associate degree level program to train these specialists. Terra Community College in Fremont, Ohio, was chosen because of its existing Plastics Program as well as its location. It was estimated that 80% of the country's coloring of plastics industry is located within a 500 mile radius of Fremont. Bob was instrumental in identifying Terra as the right partner and working with them to develop the curriculum for the program. As a result, seven courses dealing specifically with color were developed for this program. In addition, Bob served as an instructor for some or all of these courses from 1994 through 2006.



This program at Terra is the only program of its kind in the country (*or world for that matter*) that equips students with the theoretical and practical knowledge and skills needed in the specific field of color formulation in the plastics industry. Fundamentals are taught in courses on color theory and colorants. Students gain fundamental and practical knowledge of the procedures (ISO/ASTM), practices, and equipment commonly used in this industry. They learn laboratory techniques to perform colorant evaluations, colorant compounding experiments, visual color matching, and instrumental color measurement and formulation. The program at Terra graduated its first students in 1990. Since its inception, over 250 students have enrolled in the program, with over 150 graduating.

Bob's involvement with education in the field of coloring of plastics is unparalleled. Most other aspects of the plastics industry have many avenues for teaching and preparing individuals for careers in industry. The coloring of plastics industry has basically two - the undergraduate program at Terra and continuing education seminars offered by organizations like SPE. Bob Charvat is the common thread to the success of both of these avenues and the growth and success of our industry. I feel that Bob is truly deserving of this SPE Education Award.

Bruce Mulholland

INTERNET COLOR & PLASTICS COURSES THIS JANUARY



Terra Community College's Coloring of Plastics Program will be offering three internet based courses in the Spring 2008 Semester. All of these courses will be offered in a completely distance format, meaning there is no lab time involved and a student can complete any of the courses from any computer that is connected to the internet anywhere in the world at a reasonable cost.

These courses are an excellent opportunity for your quality control technicians, production technicians, or yourself to learn more about the coloring of the plastics products. These courses are designed for students that find it difficult to attend regularly scheduled classes in Fremont, Ohio because of distance or time constraints.

COURSES OFFERED IN SPRING SEMESTER (BEGINS JAN. 11, 2010)

Section VL **PET 1100 Introduction to Plastics** (3 Credits)

Fees: \$400 Ohio students \$600 out of state Books: approximately \$200

Section VL **PET 1240 Introduction to Color** (3 Credits)

Fees: \$400 Ohio students \$600 out of state Books: approximately \$200

Section VL **PET 2320 Colorants for Plastics** (4 Credits)

Fees: \$520 Ohio students \$790 out of state Books: approximately \$150

COLOR FOR PROCESSORS CERTIFICATE

The three courses above can be taken to complete a certificate program designed to give processors valuable color knowledge. Processors are experts on producing the parts that they make, however they often do not have the knowledge necessary to prevent potentially expensive color problems from occurring. These courses are designed to provide this valuable color knowledge to QC technicians, operators, production engineers, or anyone else that needs to work with the coloring of plastic parts.

For further information or to register go to: <http://www.terra.edu/academics/distance/petInternetRegister.asp>

Program Professor

Jamie Przybylski

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INVITATION TO ATTEND OUR CAD BOARD MEETINGS

The Color and Appearance Division regularly holds Technical Program Committee (TPC) and Board of Director (BOD) meetings at the ANTEC™ and the RETEC®. In addition, a Summer BOD and TPC meeting are typically held about 6-weeks prior to the RETEC®, and a Winter BOD and TPC meeting are held in early January. The Summer meeting is scheduled in various locations; the Winter meeting is typically held at the site of the RETEC® that is a year and a half away.



Any SPE/CAD members who wish to attend are welcome at these meetings. Contact the Division Chairman (*see the back cover*) for information on the location and times of any of these meetings.

COUNCILOR' REPORT



The Council meetings at ANTEC™ were held on June 20-21 in Chicago, IL. The topics covered included a number of by-law changes, state of the society and conferencing.

By-Law changes:

At the Fall 2008 Council meeting, a number of by-law changes received their first reading. Since then, they have been published in *Plastics Engineering*. These proposed changes were voted upon by the Council and passed. Most importantly, a number of these changes allow for electronic participation and voting at Council meetings. Additionally, a proposed change to the by-laws to allow Special Interest Groups to nominate Fellows and Honored Service Members received its first reading.

State of the Society:

Financially, 2009 has continued to be a difficult year for SPE. However, incomes appear to have stabilized, although at a reduced level. The sources of income have changed from conferencing to publishing. Membership continues to decline. To address the reduced income, there have been a number of actions on the part of the organization, including further staff reductions and sale of the SPE building.

SPE Headquarters Location:

The offices of SPE have moved. The PO Box and telephone numbers have not changed. The street address is: 13 Church Hill Road, Newtown, CT 06470



Conferencing:

ANTEC™ 2009 - ANTEC™ 2009 was held in conjunction with NPE in Chicago.

Attendance for ANTEC™ and the NPE seminar program was 1487. This only counts the people actually registering for ANTEC™ or a seminar. The ANTEC™ registration for the past several years has also included people attending the current exhibit. If the 2009 ANTEC™ number is compared to previous years without exhibition registrants, the number is consistent. The ANTEC™ 2009 technical program included 124 technical sessions with over 700 papers.

ANTEC™ 2010 - Next year's ANTEC™ will be held May 16-20 in Orlando, FL.

TopCons - In the first half of 2009, there have been 4 TopCons. Attendance has been down slightly, with the exception of GPEC which experienced an increase in attendance.

Virtual Conferencing - The planned first virtual conference was postponed earlier this year. It has been repositioned as the Virtual Processors Conference, scheduled for October 1-2, 2009.

EUROTEC - Originally scheduled for fall 2009, this has been postponed until fall 2011.

Respectfully submitted,

Sandra Davis

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FUTURE ANTEC™ MEETINGS



2010 - May 16-20
Orlando, Florida

2011 - May 1-5
Boston, Massachusetts

FUTURE REtec® MEETINGS

2010 REtec® Nashville, TN
Venue: Renaissance Nashville Hotel

Dates: Sept 12-14, 2010
Chair: Brian West

2011 REtec® Chicago, IL
Chair: Sharon Ehr



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The Color and Appearance Division (CAD) is committed to the publishing of at least three newsletters a year (*four, if there is sufficient material to justify the extra issue*). To that end, we would like you to think about the financial side of sponsorship of the newsletter. For the small donation of \$300 per year, we offer a business card sized (*2 x 3.5 inches*) mention in our newsletter, which goes out to the nearly 1,500 members of the CAD as well as other SPE division members. These are people active in every aspect of plastic coloring and additive technology. Larger sized spots are available at a commensurate increase in rate.

If you are interested in helping to sponsor the SPE/CAD Newsletter please contact:

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OUTSTANDING ACHIEVEMENT AWARD



Bob Charvat and Tracy Phillips jointly receive the Terry Golding Outstanding Achievement Award for their work in creating a DVD of all the technical papers from CAD RETEC®'s from 1962 through 2007.

As Roger Reinicker so eloquently stated at the 2009 RETEC® in Savannah, GA:

“The award this year goes to two individuals who like me share both a love of history and a love of education. *In fact one of these recipients has lived most all of modern history!*”

The SPE CAD tradition of technical programs goes back to 1962 and every year there has been a preprint of the papers presented. This is an interesting body of technical know-how and much of it is probably found nowhere else no matter how much you can search Google for it. These two folks recognized the value of this unique body of knowledge and led the effort to collect it, digitize it, and make it available to all our members as a searchable DVD.

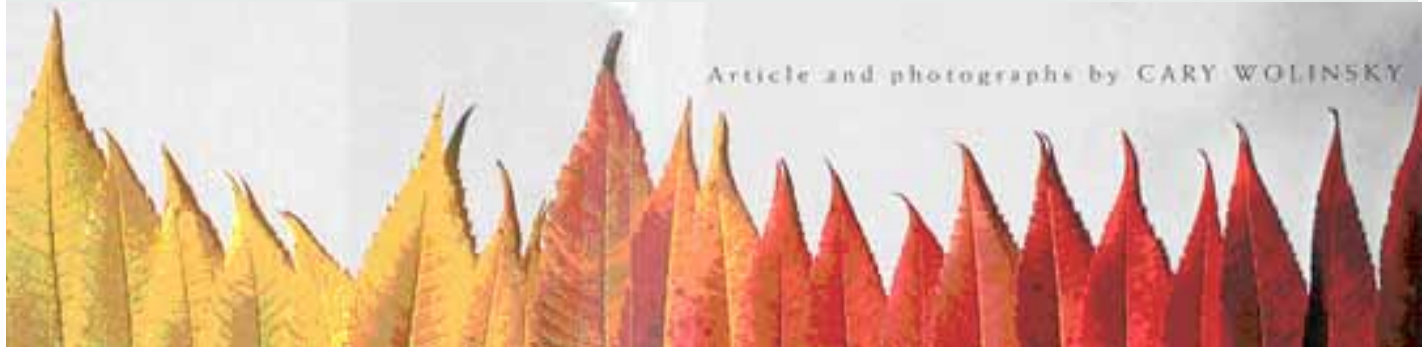
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THE QUEST FOR COLOR (CREDIT GIVEN TO NATIONAL GEOGRAPHIC)



New England Yankees call it "the Color," as in, "the Color was better last October," or ". . . must have been a dry spell that ruined the Color." Each autumn sumacs display their leaves in a dazzling palette, competing with birches and maples. Days later, the Color is gone. Like the deep blue of an October sky or the warm orange of a winter fire, it is impossible to hold. Perhaps color's ephemeral nature motivated early human's to search out ways to possess it. They watched their fires blacken cave ceilings, daubed walls with red and yellow ocher, experimented with shells, insects, flowers, roots, and bark. They mimicked animals by painting their bodies to signal aggression, to camouflage themselves from danger, to attract a mate. Sources of color were jealously guarded. Pigments of purple, saffron, and ultramarine were, at times, worth their weight in gold. Ancient cities were built on fortunes made in part from a purple dye made from mollusks. In Nuremburg a man was burned at the stake in a fire made of his own imitation saffron. Ultramarine, extracted from lapis lazuli, was reverently reserved in renaissance art for painting the robes of the Virgin Mary. In the 19th century a 19-year-old English chemistry student was the first to manufacture a synthetic dye. Suddenly the world became much more colorful. In 1907 the Lumière brothers of Paris covered a film plate with minute grains of dyed potato starch: Color photography blossomed. A crude color television, demonstrated in London in 1928, foreshadowed the glow of color in every living room. As scientists discovered the psychological influences of color, marketers manipulated consumers with the latest hues for cosmetics, fashions, and cars. Now computers have taken up the quest, imitating nature's palette in hundreds, thousands, millions of colors

ON THE NATURE OF COLOR

Philosophers, artists, mystics, and scientists have long debated the nature of color. For more than a thousand years India's astrologers have taught that the sun's white light is composed of all colors. Personified as the deity Surya, the sun is the single source of life and ruler of the eight other celestial bodies. The bodies each transmit one pure color to Earth, affecting the destiny of every living creature.



The colors are associated with gemstones: cat's-eye, hessonite, coral, sapphire, pearl, emerald, yellow sapphire, diamond, and ruby. Examples are set out above at Jantar Mantar, the 18th century astronomical observatory at Jaiper.

In the western tradition Aristotle's belief that all colors are created by mixing black and white prevailed well into the 17th century. Even Leonardo da Vinci could not decide the question, declaring at different times that there were six primary colors, or eight. In 1613 Jesuit teacher Francois d Aguilon declared that there were three primary colors: red, yellow, and blue, which together with white and black could be combined to make all colors.

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"In the beginning of the year 1666 . . . I procured me a triangular glass Prisme, to try therewith the Celebrated Phernemena of Colours," wrote Sir Isaac Newton in 1672, when making public his "New Theory about Light and Colours" (right). By intercepting a beam of sunlight with a prism, Newton proved that white light was composed of all visible colors of the spectrum and could be recombined back into white light. His ideas helped launch the era of modern optics.



Early humans created permanent colors with natural pigments. Paleolithic cave painters used numerous minerals, including blackish manganese dioxide as well as red and yellow ochre (left). Azurite and costly lapis lazuli ochre were later ground to make rare blue pigments. Even now, chunks of blue chrysocolla, a copper compound unearthed at a mine in Arizona (below), are sent to Germany, where they are pulverized for use as artists' pigment. Chemically produced colors that

reflect specific wavelengths of light meet commercial demands for automotive paint, textile dyes, and plastics. Expensive synthetic red dye even serves tradition when diluted with cornstarch on a roof in New Delhi, India (below), for use in a festival.



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◀ To create brilliant Fiesta Red dinnerware in 1936, the Homer Laughlin China Company used uranium oxide. The color was temporarily discontinued in 1943 when the U.S. government took control of uranium for the war effort and was finally dropped in 1972.



◀ In many animal species, including humans, red quickens the heart rate and causes the release of adrenaline. Men in the U.S. respond most strongly to reds with yellow mixed in; women prefer blue-based reds.

▶ "Red tape," which has come to mean bureaucratic complications, is used to bind correspondence between solicitors and barristers in England. The tape was originally dyed with safflower.



▶ The dye magenta, invented in 1859, was named in honor of Napoleon III's victory over Austria at the Lombard town of Magenta, Italy. The shade is one of the four principal inks used in color printing.



◀ Soot swept from the chimneys of peat-burning stoves is still used to dye wool on Harris in Scotland's Outer Hebrides. Peat soot produces colors ranging from light yellow-beige to deep brown.



◀ Ancient Greeks mixed pigment with hot wax to color their warships. The process was later used during the Roman period for portraits placed on Egyptian mummies in the Fayum region. Their colors remain brilliant today.

▶ Makers of traditional cheeses like Swiss, cheddar, and Gouda color their products to maintain a consistent and marketable look. But consumer preferences vary. In the U.S., Midwesterners like their cheddar orange; East Coast buyers often prefer light yellow.



▶ Crayola: It is crazy, the French word for chalk, and oia, from oleaginous (oily). Paraffin and pigment are the principal components of the more than two billion crayons Crayola makes each year.



◀ Fleas in Louis XVI's palace gave the ladies of the court fits, but when one of Marie Antoinette's favorite shades was christened puce (French for flea), the name stuck. Dyers soon offered hues called belly of flea, thigh of flea, and blushing flea.



◀ Want to keep the color? Artificial turf is exposed to intense sunlight and heat in the Arizona desert by Atlas Weathering Services Group, a firm that tests how quickly numerous products fade.

▶ Campbell Soup adopted the color red in 1898 after an executive was inspired by the red-and-white uniforms of Cornell University's football team. Many companies now score points using red, which creates the illusion of advancing toward consumers.



▶ Popular with European painters for three centuries, mummy was a rich brown pigment made by grinding the remains of Egyptian mummies.





◀ "White does not exist in nature," painter Pierre-Auguste Renoir is reported to have said. Fresh snow reflects nearly all incident light. In wind-sculpted drifts, pockets reflect the blue sky, while ridges reflect the orange of sunset.



◀ Some folks are fussy about their yolks. To satisfy German preference, egg producers feed chickens marigold petals and paprika to darken the yolks. Green eggs and ham are a different story altogether.

▶ Production of Indian yellow, an artist's pigment made in India from soil soaked with the urine of cows fed on mango leaves, was outlawed because the leaves made the sacred animals ill.



▶ When chickens see blood, they peck. Red contact lenses prevent the birds from seeing that color—and thus from killing each other. The contacts are currently being tested on 100,000 chickens in the U.S.



◀ Own a color? In 1985 the courts allowed Owens Corning to trademark pink for Fiberglas insulation. However, Nutra-Sweet was denied the right to trademark pastel blue for its Equal sweetener packets.



◀ Innates are reported to be calmer when held in coils painted a specific shade of pink. That same pink suppresses appetite, while orange stimulates it. Yellow surroundings may improve the performance of schoolchildren.

▶ We see a marsh marigold as solid yellow. With their ultraviolet vision bees see an entirely different pattern in the same flower.



THOMAS EISNER

▶ Saffron, the dried stigmas of the flower *Crucis sativus*—and the world's most expensive spice—colors risotto Milanese a golden yellow. Some 14,000 stigmas produce just one ounce of saffron.



COMPUTER IMAGE BY BRIAN E. STRAUSS, NGS STAFF



◀ Orange, the color, suffered an identity crisis, having no name in European languages until orange, the fruit, arrived from Asia. "Orange" comes from the Sanskrit *naranga*, meaning orange tree.



◀ In 1857 William Perkin, a 19-year-old Englishman, became the first person to commercially produce an artificial dye. He had inadvertently discovered the dye the previous year while trying to synthesize quinine from coal tar (left) as a treatment for malaria.

▶ Candy manufacturers often use microencapsulated colors to avoid staining the tongue. In developing countries some people prefer having a candy-stained mouth; it boasts of disposable income.



▶ Most animals and plants get their color from pigment. However, the blue in *Morpho rhetenor* butterfly wings comes from light reflected by microscopic texture variations on colorless wing scales.



Continued from page 17

SHADES OF ROYALTY

Legend attributes the discovery of purple to the Phoenician god Melkarth, whose dog bit into a seashell that turned his mouth a rich purple. Extracted from the shellfish *Murex brandaris*, *M. trunculus*, and *Purpura harmastoma*, one ounce of dye destined for royal garments require tens of thousands of mollusks. Although Tyrian purple is no longer made, dying with shellfish is still done in Oaxaca, Mexico (top right). Each winter *Purpura* mollusks are plucked from rocks. Collectors dye yarn on the spot with a secretion from the mollusks. Cloth dyed this way was once paid as tribute to Aztec rulers.



Production of the natural colorant carmine continues in the Canary Islands, where host cactuses, *Opuntia*, are "seeded" with cochineal insects (far left). The insects encase themselves in webbing and feed on the cactuses. Harvested before they lay eggs (left), the insects are dried and crushed to extract the colorant. So in demand was cochineal that vast fortunes were made by Spanish conquerors, who held a monopoly until the late 18th century, when the French and English penetrated secrets of the process and produced cochineal for themselves.



COLOR FOOLS

Artfully applied touches of color turn blobs of PVC into a display sample of a Japanese bento meal.



Plants "see" far-red, a color beyond human vision, as a signal to increase shoot growth. Using plastic mulch that reflects far-red, researcher Michael Kasperbauer tricks tomato plants into sensing competitors nearby. The tomatoes grow bigger and ripen earlier.

To understand what his colorblind patients see, optician David Harris has them computer-color a black-and-white photograph in an attempt to match an original. Harris has developed lenses with special colored filters that allow the brain to reinterpret color, thus enhancing patients' color vision.

Other colored mulches affect flavor and nutrient content.

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