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Chicago

Until the 1830s a minor trading post at a swampy river mouth near the southwestern tip of Lake Michigan, Chicago used its strategic location as the interior land and water hub of the expanding United States to become the centre of one of the world's richest industrial and commercial complexes. It is the third most populous city and metropolitan area in the United States. Chicago's achievements are distinctly characteristic of the country as a whole, and its problems are the problems of the modern United States; in a sense it may be—as a series of observers has called it—the typical U.S. city.

The relations between this youthful city and its rural environment are also noteworthy. Throughout its history, Chicago and the surrounding counties of what became its metropolitan area, now containing about two-thirds of the population of Illinois, have existed as almost a separate entity—politically, socially, and spiritually—from largely rural "Downstate" Illinois. The attitudes and lives of the early settlers in and around the burgeoning city, mainly from the Northeastern states or from Europe, were in contrast to those of Downstaters, many of whom came from Appalachian or Southern states. While Chicago was, for example, a major supplier of goods and manpower to the Union during the Civil War, in southern Illinois there was an unsuccessful but strong movement toward secession and alliance with the Confederacy. This alienation continues to plague the political and social life of both the city and the state.

This article is divided into the following sections:

Physical and human geography

THE CHARACTER OF CHICAGO

A by-product of Chicago's growth on the raw frontier of U.S. industry was its reputation as a city in which "anything goes," a city whose name became an international byword for underworld violence during and after the Prohibition era of the 1920s and early 1930s. This sort of mayhem has long been overshadowed in Chicago as elsewhere in the United States by the random violence of daily urban life. Municipal corruption, another commodity on which Chicago was long thought to have cornered the market, is likewise not in fact a local monopoly, though Chicagoans perhaps have a higher tolerance for human frailty among politicians—politics in Chicago being to an extent an expensive form of public entertainment—than do the citizens of other municipalities. As theologian Martin Marty of the University of Chicago observed, after revelations that politicians of both parties had profited enormously from ownership of racetrack stocks, "Someplace else it might be shocking. . . . Children grow up here knowing things are rigged and fixed."

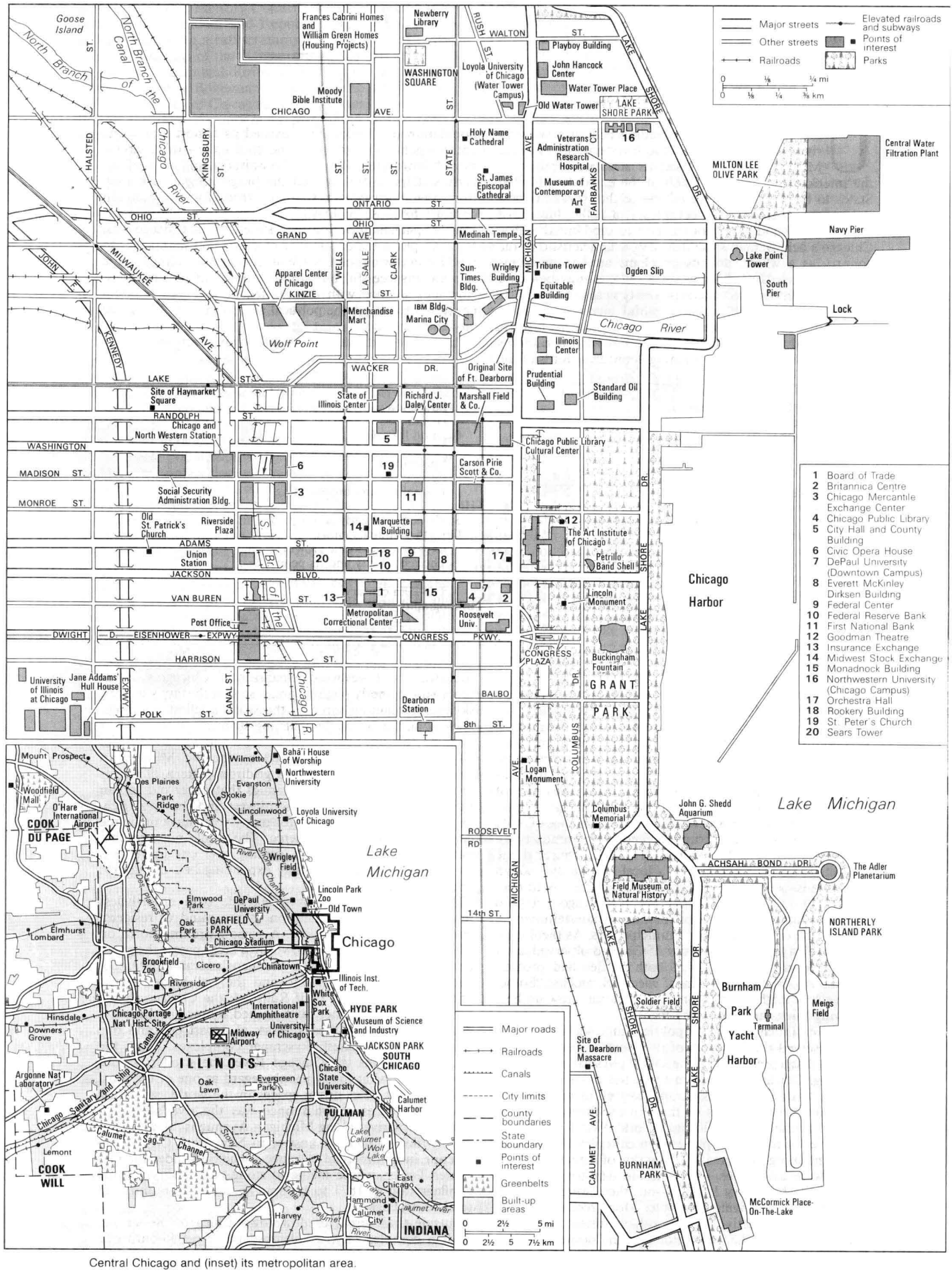
However much Chicago's political and social life may have deserved the brickbats of its numerous critics, there is little disagreement that the city's physical presence is stunning. Chicago arose from the ashes of its Great Fire in 1871 to develop the skyscraper as well as many of the other major innovations of modern architecture. In the decades immediately following World War II, however, exigencies of the marketplace often conquered civic pride in maintaining the great landmarks of Chicago's past. There were exceptions—notably, the Auditorium Building and the Newberry Library—but these were preserved through limited private initiative. More recently, public awareness and effective legislation have fostered increased conservation efforts. This factor and the desire for more land on which to build new structures have aided in the southward and westward expansion of Chicago's downtown into formerly blighted areas, so that the city's striking skyline, containing some of the world's tallest buildings, rises along a continually widening strip.

Urban vistas

Behind this impressive facade lies a sprawling industrial city, its monotony accentuated by the flat Midwestern landscape and by a repetitive gridiron pattern of streets broken only by the radial avenues that cover old Indian trails to the northwest and southwest and the great freeways and railroad lines that for many years have made the city a major hub of commerce. The whole mass reaches out over the former prairie, spilling over city limits into an irregular and continuously expanding belt of suburbs and industrial satellites.

The magnificent downtown lakeside strip nevertheless remains the focus of attention in the mind of resident, commuter, and visitor alike. A person strolling north on Michigan Avenue (in the downtown area) passes the green acres of Grant Park, with the neoclassical building of the Art Institute of Chicago and the well-hidden tracks of the Illinois Central Gulf Railroad; the Chicago Public Library Cultural Center, with arched rooms and hallways decorated with fine mosaic work of a past era; and one of the world's greatest skyscraper complexes. From the bridge that spans the Chicago River the stroller is confronted with what many people regard as one of the most beautiful and open urban spaces in the world, stretching along both sides of what once was the river's estuary. North of the river along Michigan Avenue is "the Magnificent Mile"—Chicago's answer to New York City's Fifth Avenue in commercial elegance—which includes the Old Water Tower, whose medieval stone turrets survived the conflagration of 1871 to become an eccentric monument to civic nostalgia.

Outside these areas of downtown Chicago, the stroller finds a complex city, a kaleidoscope of neighbourhoods mirroring the ethnic and racial diversity of U.S. life.



Central Chicago and (inset) its metropolitan area.

Chicago remains essentially the "blue-collar" city characterized by the poet Carl Sandburg as the "city of big shoulders," heavily populated by the descendants of labourers from the streets and soils of 19th-century Europe and of former slaves from the Deep South. The latest influx—that of Spanish-speaking residents and of immigrants from Southeast Asia and eastern Europe—has added further to the complexity.

Civic disasters of the 19th and 20th centuries

Its widely scattered ethnic neighbourhoods and its suburbs have retained memories of a long series of disasters, running from the time of the Great Chicago Fire itself. In the 19th century these included the police assault on strikers that left several wounded or killed, the apparently retaliatory bomb throwing (attributed to anarchists) that killed seven policemen, and the ensuing reaction against German-American leaders, all associated with the Haymarket Square Riot. Many other bitter, often fatal, labour disputes occurred in the steel, railroad, packinghouse, and other industries. These were followed by the catastrophic Iroquois Theater Fire; the sinking of the cruise ship "Eastland" in the Chicago River, drowning more than 800 persons; the reputation of gangsterism and intermittent mayhem evoked by mention of Al Capone, John Dillinger, and the St. Valentine's Day Massacre in the early 20th century; the televised violence between police and protesters during the 1968 Democratic convention; and a continuing succession of major and minor municipal corruptions. At the same time, "the windy city"—a meteorologically correct nickname nevertheless derived from the inflated claims of the early municipal "boosters"—has laid claim to a distinguished list of citizens who have significantly enriched the intellectual, artistic, and social life of the United States.

It has been said that Chicago's intelligentsia is hindered by a "second city" mentality and an accompanying tendency toward self-disparagement. That may indeed be true, but such a designation is also less likely to inhibit risk-taking experimentation, as evidenced by Chicago's artistic achievements. The city has once again regained its reputation as a major theatre centre, and its contemporary styles of architecture are imaginative and sometimes controversial. This willingness to try something new—epitomized by a huge abstract Picasso sculpture, a gift to the city from the artist himself—continues to entertain Chicagoans and the city's millions of tourists and conventioneers. (R.Do./Ed.)

THE LANDSCAPE

City and regional populations and areas

The city site. The city of Chicago proper occupies 228.1 square miles (590.8 square kilometres). The Chicago Standard Metropolitan Statistical Area (SMSA) consists of Cook County and five surrounding Illinois counties, and the Chicago–Gary–Kenosha Standard Consolidated Statistical Area (SCSA) is made up of nine counties—two of them in northwestern Indiana and one in southeastern Wisconsin.

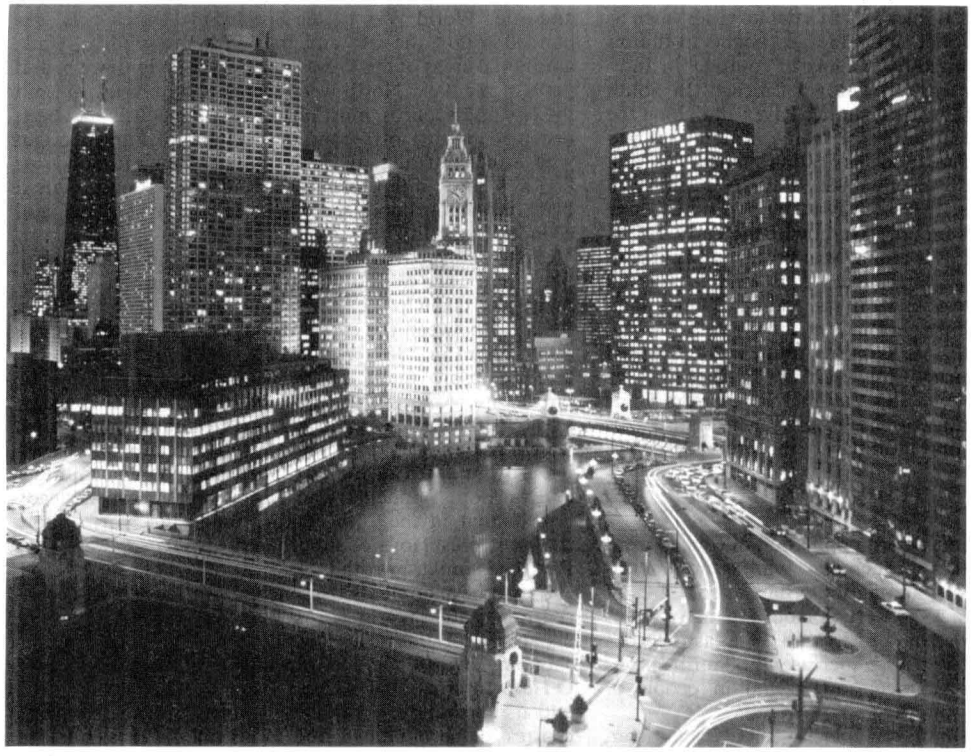
Chicago's site is generally level, rising from Lake Michigan, 579 feet (176 metres) above sea level, to slightly more than 600 feet in outlying portions of the city. Most of Chicago is built on a plain, the remnant of postglacial Lake Chicago, formed when the retreating continental glacier blocked normal northeastward drainage through the St. Lawrence Valley, about 10,000 to 12,000 years ago. Outlying portions of the metropolitan area, formed from material deposited by the glaciers, rise to more than 700 feet.

Flow of the Chicago River

The narrow Chicago River extends one mile (1.6 kilometres) inland from Lake Michigan, where it splits, dividing the city into North, West, and South sides. Its original flow was into Lake Michigan, but completion of the Chicago Sanitary and Ship Canal in 1900 reversed it, since the bottom of the canal is below the surface of Lake Michigan. Near the southeastern corner of the city, the flow of the Calumet River was reversed by the Calumet Sag Channel, completed in 1922 and enlarged from 1955 to 1972 as a modern barge route. The two waterways join southwest of the city and receive treated sewage effluent from three plants of the Metropolitan Sanitary District of Greater Chicago, as well as wastes from industrial plants and outlying areas. During high runoff the rivers occasionally revert to their original lakeward drainage, and some flooding occurs in low-lying areas.

Climate. The climate is subject to rapid changes of weather as successions of air masses pass generally from west to east. Lake Michigan tends to mitigate extremes, with lower temperatures in summer and higher in winter generally occurring close to the lake.

January temperatures average about 25° F (−4° C) and July 75° F (24° C). Annual precipitation averages about



The Chicago River, looking east. The John Hancock Center is at the far left, and the Wrigley Building, with its clock tower, is in the centre.

33 inches (838 millimetres), and heavy snows occasionally disrupt local transportation.

The city layout. Chicago meets its suburbs in a ragged pattern of boundaries on three sides, while on the east the lakefront curves from southeast to northwest. The area centring on the forks of the river was platted on a gridiron pattern in 1830 following specifications of the Northwest Ordinance of 1787. This plan was followed to some degree in the rest of the city, though it was broken often by radial avenues (some following old Indian trails leading to the river mouth) and other features, such as the Burnham Plan of Chicago (1909), rail lines and yards, industrial sites, and parks.

Downtown Chicago has been known as the "Loop" since 1897, when several elevated lines were joined into an overhead loop of tracks encircling an area that covers some 35 blocks and receiving feeder lines from north, west, and south. The building boom that began in the mid-1950s extended the highly concentrated business district westward from the Loop and, in the 1970s, into the Near West Side beyond the river's south branch. Many new skyscrapers have radically altered the city's skyline. North Michigan Avenue, initially developed following completion of the Michigan Avenue Bridge in 1920, and adjacent Near North sites have experienced much high-rise commercial and residential building since the 1960s, the most notable being the 100-story John Hancock Center and the 74-story Water Tower Place. Both are multipurpose skyscrapers containing shopping facilities, restaurants, offices, and apartments; Water Tower Place also includes a hotel. Other major downtown office buildings completed during the 1970s and early 1980s included the 110-story, 1,454-foot Sears Tower—the world's tallest building—just west of the Loop, the 80-story Standard Oil Building east of the Loop, and the Illinois Center complex of office and apartment buildings and a hotel. In the early 1980s an average of 2,800,000 square feet (260,000 square metres) of new office space was being constructed in downtown Chicago each year, in addition to a considerable volume of office-building construction in suburban areas.

Grant Park in downtown Chicago, Lincoln Park on the North Side, and Jackson and Burnham parks on the South Side stretch for miles along the lakefront. The city has an impressive park system inland as well.

Principal industrial areas lie along the two branches of the Chicago River and in the Calumet region to the southeast, as well as along railroad lines and in satellite cities, such as Waukegan, Aurora, Joliet, and Chicago Heights in Illinois and the Gary–Hammond–East Chicago complex in Indiana, up to 40 miles from downtown Chicago. In South Chicago, along and near the Calumet River and along the lakefront in adjacent Indiana, are many oil refineries and iron and steel, chemical, and fabricating plants. The first steel plant in the area was established at the entrance of the Calumet River in 1880, followed by additional large plants nearby and at Indiana Harbor in the early 1900s. Gary was established as a major steel-producing centre in 1906. In the 1960s two large steel plants were established at Burns Harbor, east of Gary in the Indiana Dunes area. Meanwhile, the principal terminal of the Great Lakes–St. Lawrence Seaway overseas shipping route was developed after 1956 by the Chicago Regional Port District in Lake Calumet, six miles down the Calumet River from Lake Michigan, supplemented by the opening in the late 1970s of the Iroquois Landing terminal at the entrance of the Calumet River.

Patterns of industrial and suburban growth

THE PEOPLE

The proportion of foreign-born population of Chicago and the metropolitan area has fluctuated with trends in immigration. For example, among the principal countries of origin in the census of 1970 were Poland, Germany, Italy, the Soviet Union, Sweden, and Ireland. The last decades of the 20th century saw a large increase in Spanish-speaking people of Latin-American origin and in people of Asian origin.

Although there were a few blacks in Chicago from the earliest period of the city's growth, immigration was accelerated during and after World War I. The black population increased from 233,000 in 1930 to almost 1,100,000 in 1990, when it represented two-fifths of the city's population.

North of the Loop, the Lake Shore Drive mansions have been replaced rapidly by equally luxurious high-rise apartment buildings that extend the lakefront Gold Coast almost to the city's border. Inland from this strip lies a narrow band of two- and three-story apartment buildings and older homes occupied largely by single persons and families of professional people.

The area adjacent to the University of Chicago on the South Side forms one of the city's major intellectual communities, though it is virtually surrounded by one of the most blighted sections of the city. Other universities contributing to local social patterns are DePaul and Loyola on the North Side and the University of Illinois at Chicago, the construction of which in the 1960s uprooted much of the old Italian community southwest of downtown Chicago.

Many ethnic and racial groups continue to form more or less homogeneous communities in various parts of the city. The Irish, long in control of the city's politics, are widespread, and a predominantly Irish region on the South Side spawned five mayors of Chicago—all Democrats. Chicago's Polish community, the largest in the country, remains heavily concentrated on the Near Northwest Side. Swedish and German neighbourhoods reach through the North and Northwest sides, and Bohemian and Slovak Czechs have spread into the southwestern suburb of Cicero, while Greeks have settled just west of the Loop.

Ethnic communities, city and suburban

Heavily Jewish populations are characteristic of the Far North and the adjoining suburbs of Lincolnwood and Skokie. The Chinese community is concentrated on the South Side, and Japanese and Korean communities mainly on the North Side, while the nation's second largest urban enclave of American Indians shares its poverty with Appalachian whites in the Mid-North area.

Many of these ethnic communities have lost most of their distinctive character as the newer generations have become homogenized into U.S. life. Foreign tongues remain in evidence, however, together with storefront restaurants and traditional shops that add old-world flavour to the Chicago neighbourhoods.

The original main axis of black settlement was along mass-transit lines, especially through the South Side, where access to industrial employment was favourable. During and after World War II, the South Side "black belt" expanded within the city and into adjacent suburbs, while additional areas of the West Side, once heavily Jewish, and parts of the Near North were occupied by blacks. In both the city and suburbs, most black areas previously had been occupied by first or second generations of foreign origin who either left already deteriorating neighbourhoods or fled a growing influx of blacks. Middle-class and affluent black neighbourhoods developed in areas of social and economic stability.

Black settlemer

Residential suburbs first grew up along the principal rail lines, but since World War II much suburban development has taken place, commonly at lower densities, in the areas between the earlier radial axes. A suburban real-estate boom in 1869 created new communities that were able to absorb many of the people burned out by the Great Fire. Among these was Riverside, west of the city, laid out in irregular streets and with exemplary planning, which has enabled the community to retain its character. To the north of the city, such lakeside communities as Evanston, Winnetka, and Lake Forest began a steady growth that in the 20th century made the North Shore the most prestigious of suburban areas. To the west, Oak Park had similar growth.

Among developments that encouraged residential deconcentration after World War II were new express highways; expansion of industries outside the city; huge regional shopping centres, the sales of which rival those downtown; O'Hare International Airport (later annexed to the city) and its surrounding complex of hotels, motels, shopping centres, office buildings, and industrial districts; nuclear-research facilities, including the Argonne National Laboratory and the Fermi National Accelerator Laboratory (Fer-

milab) near Batavia; and many communities and "new towns." The first of these, Park Forest, was begun in 1947 about 30 miles south of the city's centre.

THE ECONOMY

Industry. Chicago and its metropolitan area have remained the most important focus of economic activity in interior North America. Its economic base, with a balance between industry and commerce, is highly diversified. Nevertheless, the city has suffered, along with many other metropolitan areas of the Northeast and Middle West, from the shift in population and economic activity to the "Sun Belt" of the South and West and from foreign industrial competition.

Manufacturing provides about one-fourth of the region's employment; leading categories are steel, metal products, food products and confections, metal furniture, chemicals, soap, paint, machine tools, communications equipment and electronic goods, railroad equipment, surgical appliances, and scientific instruments.

The blue-collar and white-collar economy

Chicago's steel supply and its strategic situation as the major transportation node of the continent has enabled it to assume leadership in the manufacture of a wide variety of machinery and fabricated metal products, ranging from diesel-electric locomotives to printing presses, material-handling equipment, and earth-moving and agricultural machinery.

A wide variety of chemicals and allied products serve both industrial and consumer markets. Closely associated are several large petroleum refineries, principally in the Calumet area and northwestern Indiana.

Chicago's printing establishments include several of the world's largest. Many nationally distributed magazines and mail-order catalogs, as well as a substantial proportion of the country's telephone directories, are produced in these plants. Enormous quantities of paper, much of it from Canada, reach Chicago by water. The city ranks second to New York City in the white-collar aspects of publishing, though it tends to specialize in such areas as educational materials, encyclopaedias, and professional and trade publications. It is also the home office of several major advertising and public-relations firms.

Situated between the agricultural Midwest and the urban-industrial Northeast, Chicago remains a leader in food processing, although by the early 1970s the Union Stock Yards had terminated all meat-processing activities.

Commerce. Commercial activities of nationwide importance include trading in commodities futures on the Chicago Board of Trade and the Chicago Mercantile Exchange and associated brokerage offices and related establishments.

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Chicago has more trade shows, conventions, and corporate meetings than any other U.S. city. The Merchandise Mart, with most of its 4,000,000 square feet of floor area devoted to wholesaling activities, was for many years the world's largest commercial building. Other facilities, such as the Apparel Center of Chicago, serve specialized wholesaling industries. Convention and trade-show facilities include concentrations of hotels and motels, notably in the downtown area and in the vicinity of O'Hare Airport, together with the convention hall at McCormick Place-on-the-Lake, opened in 1971 to replace a smaller facility destroyed by fire.

Finance. Chicago is the site of a Federal Reserve Bank, established in 1914. Most large banks are in the Loop area, and, because Illinois prohibits branch banking, the outlying neighbourhoods and suburbs are served by limited-service facilities, smaller banks, currency exchanges, and savings-and-loan associations.

The city is also the site of the Midwest Stock Exchange and offices of most major brokerage houses. Many insurance companies are in the city or suburbs, including the nation's two largest automobile insurers.

Transportation. In addition to Chicago's standing as a major inland port and railroad hub of the nation, O'Hare International Airport is the world's busiest. By the late 1960s the older, smaller Midway Airport had been pressed into service again to relieve congestion. Metropolitan Chicago's dominance as the most important railroad freight centre in North America has continued, although railroad mergers, the rise of intermodal transportation, and the deregulation of many aspects of the transportation industry have presented new challenges to the region's supremacy. Chicago lost many intercity passenger trains before and after the advent of the quasi-public Amtrak system in 1971. Its several commuter lines serving suburbs to the north and west are widely regarded, however, as the finest in the nation in terms of comfort, punctuality, and overall service. The Regional Transportation Authority (RTA), established in 1973, is responsible for most suburban railroad and bus service, as well as for the rapid-transit and bus services of the Chicago Transit Authority (CTA) within the city and in some nearby suburbs. Both the CTA and RTA have become increasingly debt ridden in spite of having one of the nation's highest fare structures.

The expressway system built after World War II has become congested, as has Lake Shore Drive, which reaches nearly from the northern to southern city limits and provides scenic views of both the lake and the city skyline.

ADMINISTRATIVE AND SOCIAL CONDITIONS

Government. The spiritual chasm between Chicago and the rest of Illinois is perhaps widest in the political and social spheres and deepest in the struggles between city hall and the state government. Chicago Democrats and Downstate Republicans have found few issues over the years that could be debated on a basis other than that of partisan politics. Until the one-person, one-vote reapportionment of the legislature in the 1960s, the whip was usually in the hands of the sparsely populated Downstate counties. In addition, the growth in population and wealth of the suburbs after World War II has created a second front on which Chicago, like most large U.S. cities, is forced to wage a defensive campaign against a growing drain on its human and financial resources.

Overlap of administrative institutions

Routine operation and long-term planning in the Chicago SMSA are complicated by the continuous proliferation of overlapping administrative and taxing units of government. In addition to the almost 300 incorporated municipalities and the unincorporated areas under administration of the counties, the SMSA has more than 500 special districts—elementary and high school and community college, park, forest preserve, drainage, sanitary, and the like—established to circumvent state-imposed limitations on borrowing. Such authorities as public housing, ports, transit, and highways operate without taxing power. State and federal funds and, when appropriate, user charges supplement local outlays.

The Northeastern Illinois Planning Commission, created by the state in 1957, coordinates planning, especially among suburban governments. All projects involving federal aid must conform to the commission's comprehensive plan, adopted in 1968 and periodically reviewed, for the six counties of the SMSA.

Chicago's government long has been handicapped by an unwieldy structure not adapted to efficient administration of a modern urban region. Power is concentrated in a mayor who presides over the City Council of aldermen representing the city's 50 wards. The mayor, with City Council approval, also appoints members of the Board of Education, Park District, Housing Authority, and other special-purpose boards and commissions.

Patronage and the political machine

This formal scattering of power long has nurtured an informal but highly structured and disciplined political machine in Chicago that was brought to its peak of efficiency during the administration of Mayor Richard J. Daley, widely regarded as "the last of the big-city bosses" well before his reelection to a sixth four-year term in 1975. As chairman of the Cook County Democratic Party, he wielded great power beyond the city limits and was recognized as the predominant voice in the statewide party and a major power in the national Democratic Party. A deeply entrenched patronage system in all areas of government was moved into its highest gears for elections, and accusations and denials of voting irregularities were a constant feature of Chicago's political life. Opponents often charged that city building inspectors and other officials employed statutory sanctions to enforce party loyalty or punish dis-

affection and that the City Council, in spite of a scattering of liberal independent and Republican aldermen, served as little more than a rubber stamp for mayoral programs.

The foundations of the "Organization," as it is called by its adherents, were laid during the brief term (1931–33) of Anton Cermak, a Bohemian immigrant who quickly mastered the politics of Chicago's ethnic ghettos, opposed the Prohibition that was unpopular with immigrant workers, and carefully balanced Democratic slates and platforms among the many ethnic, labour, and business interests. Innovative programs for municipal conservation and rebuilding renewal that were begun during the reformist administration of Martin Kennelly (1947–55) were moved ahead rapidly only after Daley's accession in 1955. For more than 20 years an unofficial alliance of labour unions, civic and business leaders (often suburbanites), and party faithful from the precinct level upward, with heavy voting support from the blue-collar and ethnic communities, maintained the Organization's hold on Chicago's political life. Daley was the catalyst of the Organization's unity, and his death in 1976 marked the beginning of the end of its total dominance of city politics. In 1979 the city elected its first woman mayor, Jane M. Byrne, and by the early 1980s there were many "independent" (*i.e.*, non-Organization) Democratic aldermen in the City Council. In 1983 Chicago elected its first black mayor, Harold Washington.

The social milieu. The tremendous growth and spread of its black population and the concomitant flight of middle- and upper-class whites and of commerce to the suburbs probably was the most dominant feature of Chicago's social picture after World War II. The city's few black aldermen tended to align themselves with the political machine and bring it the votes of the black community. The growing Spanish-speaking community, without political representation, intensified the situation. The impact of these factors has been felt most heavily in housing, although pressing needs in education and in health and welfare services increasingly force the city to look to state and federal sources for relief. These requests frequently intensify hostilities between city and state governments.

Social and political interactions

Black opposition began to grow and become organized in the 1960s. One of the earliest groups to form was Operation Breadbasket—an economic activity of the Southern Christian Leadership Conference founded by Martin Luther King, Jr.—which mounted campaigns, often in conjunction with businesses and citizen groups controlled by whites, to achieve greater economic and political power for the black community. Its successor, Operation PUSH, and other organizations continued to mobilize blacks who were increasingly frustrated with Mayor Daley and the Organization. By the early 1980s massive voter-registration drives had given the black community a powerful constituency that was able to elect Washington and about one-third of the aldermen in the City Council, many of whom were independent Democrats.

Housing. A fundamental clash of values became apparent in the 1960s when Daley, in rebutting a charge that Chicago was the most segregated city in the country, declared that the city had no ghettos. Numerous restrictive real-estate practices, however, long had been in effect in Chicago, intensified by a six-day race riot in 1919 that killed at least 33 persons. Scores of incidents occurred in following years. The inevitable outward explosion of the black community after World War II was abetted by unscrupulous real-estate operators but opposed by "block organizations" and other militant white-citizen groups, especially on the South and West sides.

By 1980 the Chicago Housing Authority had built about 45,000 units of low-rent housing, mainly as massive high-rise apartment projects that, in the view of many persons, tended to intensify the crime, isolation, and other evidences of life in the slums they were intended to replace and to epitomize the worst aspects of racial and socioeconomic segregation. Private institutions, such as the Illinois Institute of Technology on the South Side, had better fortune with privately financed middle-income housing projects. A combination of redevelopment, conservation, and social programs in the area centred on the University of Chicago became a prototype for treatment of changing urban communities.

In 1971 the city's participation in the federally funded Model Cities program was jeopardized by the administration's reluctance to locate low-rent public housing in predominantly white neighbourhoods. At the same time, a number of the suburbs, many of which had fair-housing laws, resisted such housing and were largely unreceptive to pleas for housing aid from the city.

Education. The racial patterns of Chicago's public schools reflect neighbourhood residential patterns, with few attempts at integration and a relatively low standing in comparison with nationwide achievement standards. Both the public schools and the Roman Catholic parochial schools, which make up the nation's largest private-school system, have teetered on the brink of financial calamity and provoked intense city–state political feuds.

In higher education the University of Chicago long has been among the nation's most prestigious institutions. Both the Illinois Institute of Technology and Northwestern University, the latter with campuses in Evanston and Chicago, have national reputations, while Loyola and DePaul universities are major Roman Catholic institutions. Roosevelt University, in downtown Chicago, founded in 1945, offers a diverse curriculum especially geared toward an urban student body. The University of Illinois at Chicago complements the main campus in Champaign–Urbana.

Higher education

Health. Chicago is among the major medical- and dental-training centres in the nation, and its hospitals and research facilities are of high quality. A high proportion of trained personnel leave the area, however, creating an overall shortage in both the city and the state. As in many cities, service to the poor remains deficient, heavily encumbered by partisan political controversy. Publicly supported Cook County Hospital, one of the nation's largest, has often found itself embroiled in political and financial crises that tend to affect its services, while neighbourhood clinics in black and Spanish-speaking areas, staffed mainly by young doctors and medical students, have been in frequent conflict with the politically run Board of Health.

CULTURAL LIFE

The arts. Its reputation as a boisterous and crassly commercial city notwithstanding, Chicago has fostered a robust artistic life throughout most of its history. It was a major theatre centre during the late 19th and early 20th centuries, and, before the discovery of Hollywood in the early 20th century, it was the cradle of the infant U.S. motion-picture industry. During the 1950s the Second City troupe began a series of theatrical innovations that were to provide many new directions and talents to the entertainment world. The nationally recognized Goodman School of Drama, long affiliated with the Art Institute of Chicago, initiated a resident professional company in 1970 and became one of the eight colleges of DePaul University in 1978. There are numerous avant-garde companies, especially in the youth-oriented sections of the city, and several city and suburban "dinner theatres" have attained artistic acclaim.

Theatrical and musical life

The status of the Chicago Symphony Orchestra as one of the world's major musical ensembles was reinforced with critical enthusiasm after the appointment of Georg (later Sir Georg) Solti as conductor in 1969. Chicago opera revived when the Lyric Opera was founded in 1954 to provide Chicago with brief but regular seasons of opera of a high calibre. Chicago's place in literature was at its highest in the early decades of the 20th century, especially with the publication of *Poetry* magazine. Although many Chicago writers have gained renown, the city's peculiar literary genius has shown itself most prominently in the field of journalism—from bucolic Midwestern homily to stinging social and political commentary.

Although Chicago and environs have incubated the most outstanding examples of modern domestic and commercial architecture, the city's record in preserving its landmarks has been a depressing one. The razing of Louis Sullivan's Stock Exchange Building in 1971 epitomized to conservationists and historians a callousness toward the city's aesthetic heritage that already had replaced nu-

Architecture

merous architectural landmarks with more profitable but uninspired buildings. Considerable interest has developed, however, in preserving Chicago's older buildings of architectural value, and the results are evident in the rehabilitation of many structures. Others have been adapted to new and innovative uses, including Fulton House, a former warehouse converted to a luxury apartment building, and the buildings in Printing House Row.

Architecturally Chicago remains among the finest of the world's large cities, but its plan and skyline have been threatened by an increasing number of conventionalized structures indifferently adapted from the buildings of Ludwig Mies van der Rohe, an innovative genius who had renewed Chicago's architectural history in the years following World War II.

Museums. Its many and diversified collections of painting, sculpture, prints, photographs, and handicrafts rank the Art Institute of Chicago among the major museums of the world. In addition, its school makes it an important training centre for the fine arts. The Museum of Contemporary Art provides Chicagoans with a complementary point of view through its exhibitions of the leading edge of artistic endeavour. There are also several commercial galleries that sponsor exhibitions of works by artists with local as well as national and international reputations.

The exhibitions of the Museum of Science and Industry, housed in a huge remnant of the world's fair of 1893, are rivalled in the United States only by those of the Smithsonian Institution in Washington, D.C. The public displays and research activities of the Field Museum of Natural History place it among the leading scientific institutions of the world. Nearby are the John G. Shedd Aquarium and the Adler Planetarium.

Recreation. The city's extensive park system is supplemented by forest preserves located along the original city limits and in suburban areas of Cook County. Sandy beaches, in intermittent patches along Lake Michigan, provide summertime recreation.

Professional sports spark civic enthusiasm for the White Sox and Cubs in baseball, the Bears in football, the Black Hawks in hockey, the Sting in soccer, and the Bulls in basketball. For Chicagoans and visitors alike, the many entertainments available in the Near North Side area of nightclubs and cabarets are a continuous attraction.

Journalism and broadcasting. Chicago has two metropolitan daily newspapers: the *Chicago Tribune* and the *Chicago Sun-Times*. The *Chicago Defender* is oriented primarily to the city's black population. There are many suburban newspapers and weekly and monthly magazines, as well as several dailies and weeklies in foreign languages. *Chicago Commerce*, a monthly, and *Crain's Chicago Business* carry economic and financial news. The magazine *Chicago* features general articles, stories of local interest, and entertainment notes. Chicago has numerous television and radio broadcasting stations; the public television station, WTTW, was one of the nation's pioneers in educational programming.

History

SETTLEMENT AND EARLY ACTIVITY

In 1673 the French explorers Louis Jolliet and Jacques Marquette followed an Indian portage to the mudflats over which a Y-shaped river flowed. It emptied into Lake Michigan, while its arms reached nearly to the drainage basin of the Mississippi River system, thus virtually linking two great North American waterways. The meaning of the Indian name for the region remains disputed—among the possibilities are skunk, wild onion, or powerful.

Trappers, traders, and adventurers used the area for portage and barter throughout the 18th century. The first known non-Indian settler was Jean Baptiste Point Sable (or Pointe du Sable), son of a wealthy French merchant who had moved to Haiti and married a black woman there. Sable settled in the Great Lakes area in the 1770s. In 1795 the United States obtained a six-mile-square area about the river mouth.

Ft. Dearborn, built in 1803, was destroyed in 1812 and all but one of its military and civilian population were killed in an Indian raid. The fort was rebuilt in 1816 and was occupied until the 1830s. Outside its walls a cluster of traders' shacks and log cabins were built, but the settlement attracted little interest even after Illinois, with most of its population in the central and southern regions, became a state in 1818.

The opening of the Erie Canal in 1825, joining the Atlantic states and the Great Lakes, shifted the main axis of westward movement northward from the Ohio River route. Soon afterward, Chicago became the principal western terminus. The county of Cook located its seat at the small community, and the regional federal land office opened there. Numerous retail stores opened to outfit newcomers to the West, and the volume of animal pelts and products for Eastern markets increased. In 1837, the year Chicago became incorporated as a city, its population was about 4,200.

Chicago's geographical potentiality as a water gateway was fulfilled by completion in 1848 of the Illinois and Michigan Canal, linking the Great Lakes and Mississippi systems. A pair of railroad lines from the East tied into Chicago in 1852, and by 1856 it had become the nation's chief rail centre. A belt line connected the radiating trunk lines by 1856, and commuter service to outlying neighbourhoods and suburbs began.

Emergence as a rail centre

GROWTH AND DEVELOPMENT

Explosive economic growth. Industry followed the rails. By the late 1850s lake vessels carried iron ore from the Upper Michigan ranges to the blast furnaces of Chicago. Chicago became the nation's major lumber-distributing centre by the 1880s. The railroads brought farm produce from west and south, and Chicago's Board of Trade became the nerve centre of the commodities market. The railroads also hauled cattle, hogs, and sheep to Chicago for slaughtering and packing. The consolidated Union Stock Yards, largely bankrolled by nine railroads and the owners of several other Chicago stockyards, opened on Christmas Day, 1865.

Chicago emerged as the major city of the Midwest. Its 1880 census reported more than 500,000 inhabitants, a 17-fold increase over 1850; by 1870 it had exceeded St. Louis, Mo., in population. It was the site of the 1860 Republican National Convention at which Illinoisan Abraham Lincoln won the presidential nomination. Both Americans and northern European immigrants, drawn by Chicago's factories and carried by the rail network that was anchored in Chicago, continued to pour into the city.

The Great Chicago Fire

Four square miles of Chicago, including the business district, were destroyed by fire on October 8–10, 1871. Starting in the southwest, fed by wooden buildings and pavements and favoured by a long dry spell, flames spread northeastward, leaping the Chicago River and dying out only when they reached Lake Michigan. About 250 lives were lost, some 90,000 people were made homeless, and almost $200,000,000 in property was destroyed.

The rebuilt city and its people. Much of the city's physical infrastructure remained, however, including its water-supply and sewage systems and transportation facilities. Chicago rebuilt rapidly in a similar pattern, although with buildings that were more modern and in conformance with new fire regulations.

The central business district, bounded by the Chicago River to the north and west and by the railroad along the lakeshore to the east, held the major department stores, the larger banks, the Board of Trade, the regional headquarters of rising national corporations, and the centres of commerce, law, and government. The district was the birthplace of the steel-frame skyscraper. Completion of the Home Insurance Building in 1885 led during the next nine years to the construction of 21 buildings ranging from 12 to 16 stories throughout the downtown area. Commuter railroads, horse, cable, and electric street railways, and elevated rapid-transit lines served the Loop.

The Lake Michigan shore became the centre for the homes and civic pursuits of Chicago's economic and social elite. Lake Shore Drive north of the Loop emerged as the mainline for society—the Gold Coast, it was soon nicknamed. Although blighted by the Illinois Central Railroad

yards, the waterfront land to the east of the Loop was nevertheless landscaped and named Grant Park.

Heavy industry, warehouses, and rail yards crowded the banks of the Chicago River. Industrial pockets also existed at Chicago's outskirts. At the far south, where the Calumet River met Lake Michigan, the steel mills drew a polyglot community of blue-collar workers and their families. The Union Stock Yards dominated another South Side area, the Back-of-the-Yards district, which was made infamous in Upton Sinclair's scathing novel of industrial oppression, *The Jungle* (1906). Public health and sanitary conditions were an outrage: until 1900 Lake Michigan both supplied fresh water to Chicago and received its untreated sewage, a condition probably responsible for the city's frequent epidemics.

The second wave of foreign immigrants

Many of the working families arrived in the second great wave of European immigration: Russian Jews, Italians, Poles, Serbs, Croatians, Bohemians, and other groups from southern and eastern Europe. The 1890 and 1900 censuses showed that more than three-fourths of Chicago's population was made up of the foreign-born and their children.

The working districts were fertile ground for social action. The labour movement left the mark of its early attempts at industrial organizing: the Haymarket Riot of 1886, in which workers and lawmen alike died; and an 1894 strike against the Pullman Palace Car Company, led by pioneer organizer Eugene V. Debs and others. Social work was another influence: Jane Addams and her followers at Hull House, a West Side settlement, tried to improve the wretched conditions of housing and health there.

In 1889 Chicago annexed numerous inner suburbs, doubling its area and its population (to almost 1,100,000) and surpassing Philadelphia as America's second most populous city. By 1900 it was a centre of nearly all parts of the U.S. economy as well as of social insurgency and reform, immigration, education, and even culture. Chicago also had developed a brawling spirit evident not only along the dingy streets of the immigrant ghettos but also in corporate boardrooms and in the most elegant brothel in the nation, which entertained royalty from abroad and millionaires from the newly sprawling suburbs.

This Chicago was particularly striking to writers and visitors. "I have struck a city—a real city—and they call it Chicago," wrote Rudyard Kipling. "The other places don't count." And, he continued, "Having seen it, I urgently desire never to see it again. It is inhabited by savages."

Symbols of civic consolidation. A major expression of the city's character was the Plan of Chicago (1909), by Daniel H. Burnham and Edward H. Bennett, which took the general outlines of turn-of-the-century Chicago, added the notions of style possessed by the city's industrial and mercantile elite, and presented a vision of the future. The plan was inspired by the 1893 World's Columbian Exposition—for which Chicago outbid New York City, Philadelphia, and Washington, D.C.—celebrating the 400th anniversary of the discovery of America. Built on the Midway Plaisance adjacent to the University of Chicago (endowed in 1891 by John D. Rockefeller), the exposition's buildings have been called a stylistic union of Classical Greece, Imperial Rome, Renaissance Italy, and Bourbon Paris.

The World's Columbian Exposition of 1893

Nonetheless, the exposition stimulated activity in city planning not only in Chicago but also throughout the world. The "City Beautiful" movement dominated civic thought for several decades, influencing even some federal buildings in Washington, D.C. The Classicism of the exposition was in marked contrast, however, to the modern Chicago School of architecture, and the two trends proceeded concurrently during the following decades. Chicago became a world centre of architectural innovation in the late 19th and early 20th centuries, with many notable buildings by Dankmar Adler, Louis Sullivan, Frank Lloyd Wright, and Henry H. Richardson.

Features of the Burnham Plan

The Burnham Plan, as it came to be called, proposed many subsequently developed features: park areas along Lake Michigan that included beaches, boulevards, and yacht basins; a belt of forest preserves rimming the city for recreation; the widening of arterial streets; a civic centre; and a double-decked boulevard in the central area along the Chicago River. Until 1939 the quasi-official Chicago Plan Commission promoted individual features of the plan, which, like Burnham's admonition, "Make no little plans," came to have a profound effect on Chicago.

The 20th century. Chicago's population growth was less spectacular in the 20th century, though industrial expansion associated with World Wars I and II and the postwar prosperity continued to attract newcomers. Most pronounced was the influx of blacks from the South seeking industrial employment. A building boom in the city and suburbs terminated abruptly following the stock-market collapse of 1929, and during the next decade the population increased only slightly, to about 3,400,000 in 1940. Possibly contributing to this slowed growth were the worldwide notoriety of Chicago (only in part deserved) as the playground of underworld figures during the Prohibition era, the failure of several Chicago banks during the Depression of the 1930s, and the allegedly powerful grip of criminal syndicates on many aspects of economic and political life. In contrast, however, the suburban population increased rapidly during this period.

After World War II construction was slow to resume until Daley's election in 1955. Massive rebuilding programs became a hallmark of his terms in office, including an almost total alteration of the skyline of the Loop and adjacent areas. As in most cities the downtown area, although it continued as the centre for offices, suffered from a decline in other functions, including retailing, entertainment, and wholesale distribution, while rapid expansion of those activities took place on the periphery and in suburban areas. The 1970 census revealed that, for the first time, the city itself had less than half of the metropolitan population.

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(H.M.M.)

Childhood Diseases and Disorders

The term childhood diseases denotes those diseases that characteristically occur during an age span that begins with the fetus and extends through adolescence. This is a period typified by change, both in the child himself and in his immediate environment. Changes in the child related to growth and development are so striking that it is almost as if the child were a series of distinct yet related individuals as he passes through infancy, childhood, and adolescence. Changes in the environment occur as the surroundings and contacts of a totally dependent infant become those of a progressively more independent child and adolescent. Health and disease during the period from conception to adolescence must be understood against this backdrop of changes.

Although, for the most part, the diseases of childhood are similar to those of the adult, there are several important differences. For example, certain specific disorders, such as precocious puberty, are unique to children; others, such as acute nephritis—inflammation of the kidney—are common in children and infrequent in adults. At the same time, some diseases that are common in adults are infrequent in children. These include essential hypertension (high blood pressure of unknown cause) and gout. Finally, a major segment of pediatric care concerns the treatment and prevention of congenital anomalies, both functional and structural.

Apart from variations in disease due to differences between children and adults, certain other features of diseases in children need to be emphasized. Infectious disorders are prevalent and remain a leading cause of death, although individual illnesses are often mild and of minor consequence. Most instances of the common communicable diseases, such as measles, chicken pox, and mumps, are encountered in childhood. Disorders of nutrition, still of great concern, especially but not exclusively in developing countries, are of extreme importance to the growing and developing child. The unique nutritional requirements of children make them unusually susceptible to deficiency states: vitamin-D deficiency causes rickets, a common disorder of children in developing countries, and only rarely causes any disease in adults. The major environmental hazards that endanger the health of young children are either unavoidable, as in air pollution, or accidental, as in poisoning and in traffic injuries. Older children, especially adolescents, are exposed, as are adults, to environmental hazards that they deliberately seek, such as cigarette smoking and the use of alcohol and other drugs.

This article reviews the scope of diseases that affect children, with particular emphasis on the ways in which the unique attributes of the growing child and special aspects of his environment serve to modify the course, effects, and treatment of particular diseases.

The article is divided into the following sections:

DIAGNOSIS AND GENERAL CONSIDERATIONS OF TREATMENT AND PREVENTION

Diagnosis of the diseases of childhood involves special considerations and techniques; for example, in evaluating genetic disorders, not only the patient but his entire family may need to be examined. Inapparent environmental causes of diseases, such as poisonings, must be considered and investigated thoroughly, by methods that at times resemble those of a detective. Diseases of the fetus may derive directly from disorders of the mother or may be caused by drugs administered to her. Diagnostic techniques have been developed that permit sophisticated examination of the fetus despite its apparent inaccessibility. The withdrawal of a small amount of the amniotic fluid that surrounds the fetus permits examination of fetal cells as well as the fluid itself. Chromosomal and biochemical studies at various stages of development may help to anticipate problems in the postnatal period; they may indicate the need for immediate treatment of the fetus by such techniques as blood transfusion; or they may lead to the decision to terminate pregnancy because serious, untreatable disease has been recognized. Other specialized techniques permit examination of the fetus by X ray and ultrasound, and by electrocardiography and electroencephalography (methods for observing and recording the electrical activity of the heart and the brain, respectively). Fetal blood can be obtained for analysis, and certain techniques permit direct viewing of the fetus.

In examination of the infant, inaccessibility is no special problem, but his small size and limited ability to communicate require special techniques and skills. Of even more importance, however, is the fact that adult norms cannot be applied to younger age groups. Pediatric diagnosis requires knowledge of each stage of development, with regard not only to body size but also to body proportions, sexual development, the development and function of organs, biochemical composition of the body fluids, and the activity of enzymes. The development of psychological and intellectual function is equally complex and requires special understanding. Since the various periods of growth

Stages of growth and development

and development differ so markedly from one another, they are divided for convenience into the following stages: intrauterine (the period before birth), neonatal (first four weeks), infant (first year), preschool (one to five years), early school (six to 10 years for girls, six to 12 for boys), prepubescent (10 to 12 for girls, 12 to 14 for boys), and adolescent (12 to 18 for girls, 14 to 20 for boys). Only if appropriate norms are established for each stage of development can the child's condition be adequately evaluated and the results of diagnostic tests properly interpreted. Thus, it is of no concern if a 12-month-old infant is unable to walk alone, although some infants are able to do so at nine months of age. The crucial question is at what age one becomes concerned if a developmental milestone has not been reached. Five-year-old boys average 44 pounds (20 kilograms) in weight but may vary from 33 to 53 pounds (15 to 24 kilograms). The hemoglobin level that is of no concern in the three-month-old infant may reflect a serious state of anemia in the older child. The blood levels of certain enzymes and minerals differ markedly in the rapidly growing child from those in the late adolescent, whose growth is almost complete. Failure of a 15-year-old girl to have achieved menarche (the beginning of menstruation) may be indicative of no abnormality in sexual development but requires careful evaluation.

Treatment of childhood disease requires similar considerations with regard to various stages of growth and development. Variation in drug dosage, for example, is based not only on body size but also on the distribution of the drug within the body, its rate of metabolism, and its rate of excretion, all of which change during various stages of development. The inability of infants and small children to swallow pills and capsules necessitates the use of other forms and alternate routes of administration. Drug toxicity of importance at one stage of development may be of no concern at another; for example, the commonly used antibiotic tetracycline is best avoided in treatment of the child younger than age 10 because it is deposited in teeth, in which enamel is also being deposited, and stains them. When permanent teeth are fully formed, the deposition of tetracycline no longer occurs. The delayed consequences of certain forms of treatment, especially with radioactive isotopes—substances that give off radiation in the process of breaking down into other substances—might be of no consequence in the case of an elderly person with a life expectancy of 10 or 20 years but might deter a physician from the use of such treatments for the infant with his whole life in front of him. Finally, the nutritional requirements of the growing child must be considered when treatment of disease requires modification of the diet or administration of drugs that may affect the absorption or metabolism of essential nutrients.

Prognosis

The outlook for recovery from diseases in children is often better than it is for adults, since the child's additional capacity of growth may counteract the adverse influences of disease. The bone fracture that results in permanent deformity in the adult, for example, may heal with complete structural normality in the child, as continued growth results in remodeling and reshaping of the bone. Ultimately, the infant who has one kidney removed because of infection or tumour most likely will have entirely normal renal (kidney) function because the remaining kidney will increase its size and functional capacity with growth. In contrast, removal of one kidney in the adult usually results in a residual functional capacity equal to 70 to 75 percent of that of two normal kidneys.

Thus, being in a period of rapid growth and development may favourably affect the child's recovery in the course of a disease. The converse may also be true, however. The rapidly growing and maturing central nervous system, for example, is particularly susceptible to injury during the first two or three years of life; also, adolescents may react unfavourably to psychological stresses that are tolerated readily by more mature individuals.

Prevention of childhood disease

In the general consideration of childhood diseases, a final aspect that merits emphasis is the role of prevention. The major factors responsible for the decline in infant and childhood mortality rates over the past decades have been the development and application of preventive measures. By the late 20th century, in most countries the death rate for infants under one year of age had decreased until it was scarcely more than a 10th of the rate in the 1930s. Socioeconomic factors—such as better maternal nutrition and obstetrical care and improved housing, water supplies, and sewage disposal—have been of prime importance in this decline, together with better hygiene at home, safer infant feeding techniques, and widespread immunization against common infectious diseases. In comparison to the favourable effect of these and other preventive measures, an increased capacity to treat diseases, even with such powerful tools as the antibiotic drugs, has had relatively little impact. In the developed countries, where the most common causes of childhood morbidity and mortality are accidents, prevention depends upon a willingness to design and modify communities and homes to make them safer for children. Just as important as the development of public health measures is their practical application; underutilization of established procedures and techniques for prevention of disease is a major health problem.

DISEASE-AFFECTING DIFFERENCES BETWEEN CHILDREN AND ADULTS

Disturbances in growth may be among the most striking consequences of disease in children. An obvious example of this effect is total growth failure, which is seen in almost every serious disease of infants and children. Local retardation or disturbance in growth patterns may be equally striking. Osteomyelitis, an infection of bone, may, for example, result in retardation or cessation of growth at that site, with subsequent severe asymmetry between the affected limb and its normal counterpart. Enlargement of the heart as a result of cardiac disease may cause gross distortion of the chest, as the growing ribs adapt to the abnormal shape of the heart.

Many differences in the manifestations of disease in children and adults can be ascribed to differences in anatomical structure and in biochemical, immunological, and physiological function. Less well understood are the consequences of differences in psychological function. In general, the younger the child, the more striking these differences are.

Anatomical differences. Not only is the child's body smaller than that of the adult, but it has different proportions; for example, the sitting height of the newborn infant represents about 70 percent of total body length. With rapid growth of the extremities, sitting height decreases to about 57 percent of the body length at three years of age and, finally, as growth proceeds more slowly, to the adult proportion of about 50 percent. Growth and development are not necessarily smooth, continuous processes. Weight and height increase rapidly in infancy and at puberty; for example, the head completes half its total growth in the first year of life, and by the age of two years the child has reached half his adult height. In addition to differences in proportion and size, there are marked differences in body composition between children and adults. As examples, in newborn infants muscle mass constitutes approximately 25 percent of total body weight, compared to 43 percent in adults. Total body water, which accounts for 90 percent of early fetal weight, represents 75 percent of body weight at birth, drops to about 60 percent by one year of age, and then declines gradually to reach the adult figure of 55 percent. The higher proportion of body water, due almost entirely to a relatively greater volume of fluid outside the cells, affects the response of the infant, particularly to disturbances in water balance.

Differences in body composition

There are many examples of differences in anatomical structure that affect manifestations of disease. In assessing the health of the infant with cardiac or pulmonary (lung) disease, the thinner chest wall, the relatively more horizontal position of the heart, and the more rapid cardiac and respiratory rates must be taken into account. The thin abdominal wall of the infant permits palpation—examination by touching with the fingers—of the kidneys, whereas in older subjects the kidneys usually can be felt only if they are abnormally large. In the infant, with the bones of the skull still not fused together, obstruction of the flow of cerebrospinal fluid may result in striking enlargement

of the head, a condition referred to as hydrocephalus. In the older child, when the skull sutures have fused, such enlargement is not possible, and the manifestations of spinal-fluid obstruction are similar to those of the adult, including severe headache and visual difficulties as a result of increased intracranial pressure. The primary manifestation of mumps is a painful swelling of the parotid and other salivary glands. In adolescents, involvement of the testes or ovaries occurs only rarely, a phenomenon related in some way to the immaturity of these organs. In the adult, particularly in the male, severe sex-gland involvement is common.

Physiological differences. Physiological differences between children and adults that cause differences in the manifestations of disease include all the various functional, endocrine, and metabolic features of the growing and maturing organism. A major characteristic in this regard is the limited ability of the infant to maintain homeostasis (a stable internal environment) during illness because of his greater metabolic and nutritive requirements. Moreover, most of the first year of life is characterized by immaturity of renal function, the capacity of the kidneys to respond to the stresses of disease being less than later in life. The baby with severe diarrhea, for example, cannot conserve water well enough and may become dehydrated. With any degree of stress, metabolic abnormalities are likely to be more severe in the infant than in the older child.

The liver of the newborn child also demonstrates certain features of immaturity. Of particular importance is its limited capacity to excrete bilirubin, a product of the breaking down of hemoglobin (the oxygen-carrying pigment of red blood cells). In certain conditions in which there is a rapid rate of destruction of red blood cells, the inability of the liver to excrete the added load of bilirubin may result in a large increase in the concentration of this substance in the blood; the bilirubin concentration, if high enough, can cause severe brain damage known as kernicterus. Since immaturity of the brain also contributes to the infant's increased susceptibility to this disorder, kernicterus is rarely encountered outside of the neonatal period, even in subjects with severe liver disease.

The ability of the young infant to metabolize and to excrete certain drugs is limited by the immaturity of the liver and of the kidney, and drug dosage must be adjusted accordingly.

Immunologic responsiveness

The immunologic system of the body is responsible for the defense against disease. This highly complex system involves the production of antibodies (proteins that can recognize and attack specific infectious agents); the action of granulocytes and macrophages, cells that destroy infecting organisms by ingesting them (a process called phagocytosis); and the function of a variety of cellular mechanisms involving the complement system (complement is an enzyme-like substance in the blood). Antibody production in the infant is qualitatively and quantitatively different from that in the older child and adult. Although the differences in antibody response cannot be related specifically to differences in the capacity of the infant to withstand infection, they certainly must play some role. On the other hand, many of the clinical features of infectious disease occurring during the first two or three years of life appear to be related to the fact that these are infections occurring for the first time.

Another difference in immunologic response between children and adults is in the functioning of the reticuloendothelial system. This system, which is composed of the macrophages found in the lymph nodes, spleen, and other lymphatic tissues, is relatively more active in childhood. Since macrophages ingest infectious organisms, children with coryza or sore throats commonly have swollen lymph "glands" visible and palpable in the neck. Similarly, their tonsils and adenoids, which are lymphatic tissues, swell rapidly in response to mild infections.

DISORDERS PRESENT AT BIRTH

Diseases transmitted through the placenta or due to placental dysfunction. Infectious diseases of the fetus are caused by many different types of organisms, including viruses, bacteria, spirochetes, and protozoa (*e.g.*, toxoplasmosis). Most of these infections are the result of infection of the mother, the infectious agents being transmitted through the placenta (the temporary organ by means of which the fetus receives nourishment and discharges waste) by way of fetal circulation. Bacterial infection is most often associated with premature rupture of the membranes and infection of the amniotic fluid.

Maternal rubella (German measles) occurring during the first eight weeks of pregnancy is associated with congenital malformation of the fetus in more than 50 percent of cases, the figure decreasing to about 20 percent by the 16th week and dropping sharply thereafter. Infection of the fetus with a virus of the cytomegalovirus type involves many organs, has a high fatality rate, and may result in severe brain damage in fetuses who survive. Infection by the intracellular parasite *Toxoplasma gondii* produces a disease called toxoplasmosis, which may cause death or may result in microcephalus (abnormal smallness of the head), hydrocephalus (excessive accumulation of fluid in the brain cavities), or mental retardation. Congenital syphilis may have a variety of effects in the infant, including involvement of the skin, liver, spleen, lymph nodes, and kidneys. Malformations of the bones and teeth appear later, and severe involvement of the central nervous system may become apparent after many years.

Just as infectious agents may cross the placenta, so also most drugs administered to the mother may pass through the placenta and have important effects on the fetus. A most dramatic and devastating example of this effect occurred in Europe during the early 1960s, when the birth of thousands of infants with absent or short limbs resulted from the maternal ingestion of the apparently harmless drug thalidomide. Anesthetics, analgesics (pain relievers), sedatives, antihypertensive drugs, and antibiotics all may have adverse effects on the fetus. Congenital goitres (enlargement of the thyroid) have been produced by administration of antithyroid drugs to the mother. It is now clear that adverse effects on the fetus must be considered whenever drug therapy of the mother is contemplated.

The abuse of narcotics or alcohol by the mother can also lead to dire fetal consequences. Infants born to mothers addicted to heroin, morphine, or other opiates commonly share their mothers' addiction and suffer withdrawal symptoms within 72 hours of birth. Many infants of alcoholic mothers are afflicted with a combination of malformations, known as the fetal alcohol syndrome, which include mental retardation, growth retardation, and microcephaly.

The entire nutrient supply of the fetus derives from the mother. Although maternal deficiency states may, therefore, be reflected by parallel deficiencies in the fetus, in general the needs of the fetus will be met ahead of those of the mother, and an adequate amount of a given nutrient may be supplied to the fetus, despite maternal deficiency. Mild to moderate deficiencies of iron or calcium in the mother, for example, are not usually associated with deficiencies in the fetus. On the other hand, protein and caloric malnutrition may be associated with decreased fetal size.

Placental insufficiency

Deficiencies in the fetus may also arise from placental dysfunction (malfunctioning). The consequences of abnormalities of the placenta depend upon the time of onset and the severity of placental inadequacy. Serious placental insufficiency early in pregnancy may result in the death of the fetus. It is also likely that placental insufficiency can be a factor in decreasing fetal growth. Toward the end of pregnancy, placental dysfunction is associated with premature delivery or evidence of varying degrees of fetal distress, ranging from yellow staining of the skin to fetal wasting and to signs of severe lack of oxygen.

Injuries incurred during birth. The physical trauma of delivery may result in a number of injuries to the infant. Of little consequence is the diffuse soft-tissue swelling of the scalp referred to as caput succedaneum. Difficult delivery may result in more extensive bruising, abrasions, and edema—particularly after breech delivery; however, serious harm is rare. Bleeding under the periosteum (the covering membrane) of the skull produces a large swelling in 1 to 2 percent of babies, and in some it is associated with a small fracture of the underlying skull; fortunately, spontaneous healing occurs speedily. Injuries to the spinal

cord are rare, but injuries of peripheral nerves as a result of traction on the head are not uncommon. Such injuries include Erb's paralysis, with weakness of the arm and shoulder because of damage to the fifth and sixth cervical nerves. Injury to the phrenic nerve, with paralysis of the diaphragm—the muscular partition between the chest and the abdomen—and facial-nerve injury resulting in facial palsy also are encountered. In the vast majority of such instances of peripheral-nerve injury, recovery is complete.

An extremely important form of birth injury is that associated with lack of oxygen (anoxia). Fetal anoxia may occur from inadequate oxygenation of the mother, low maternal blood pressure, or abnormalities in the uterus, placenta, or umbilical cord that result in inadequate blood flow to the fetus. After birth, anoxia may result from blood loss, shock, or inadequate respiration. Clinical manifestations include decreased activity, slowing of the heart, and blueness of the skin (cyanosis). Severe anoxia may cause death of the newborn, although recovery is more common. The major significance of anoxia is that it may result in brain damage if prolonged more than a few minutes.

Definition of prematurity

Prematurity and low birth weight. The usual length of the gestation period is 40 weeks. Infants born prior to 37 weeks of gestation are considered to have been born early and are referred to as preterm or premature. Infants who at birth weigh 2,500 grams (about 5.5 pounds) or less are considered to be of low birth weight and either are prematurely born or have had less than the expected rate of growth within the uterus.

Infants whose weight is low at birth account for as many as 10 to 15 percent of births among low socioeconomic groups and as few as 4 to 5 percent of births among those of higher socioeconomic status. Clinical examination of the baby helps to differentiate between the preterm baby and the small baby born at term, but such determination of gestational age (the age from conception to birth) is not precise. The correct classification of the baby is important because maturity, in terms of gestational age, is a major factor determining the ease with which the baby will adapt to life outside the uterus. In the infant born too early, many organ systems will not be fully developed. The preterm infant who is large and only slightly immature does as well as the full-term infant, but the very small preterm infant, below 1,000 grams (about 35 ounces) in weight, has a high fatality rate and is prone to many complications.

The complications encountered in coping with extrauterine existence involve primarily the respiratory and gastrointestinal systems. In addition to anatomical immaturity of the lungs, a handicapping feature of the premature infant may be a lack of a substance called a surfactant, which plays an important role in permitting the air spaces, or alveoli, of the lungs to remain open. Surfactant appears in some fetuses at 24 weeks' gestation but is absent in others until about 30 weeks. Because of these respiratory handicaps—particularly the lack of surfactant—many premature infants suffer from respiratory distress syndrome, a condition described below under *Respiratory disorders.*

Inability to suck adequately and limitations in the capacity to digest foodstuffs and absorb them through the intestinal tract provide other serious handicaps for the premature infant. To circumvent these problems, infants may be fed (by stomach tube) specially prepared formulas tolerated by even the smallest of babies.

The relatively large surface area of the small infant and his inability to maintain body temperature may require his being kept in an incubator. In addition to temperature control, the incubator makes it possible to provide extra oxygen to the infant who has respiratory difficulties, although this must be done with care because excessive oxygen may lead to damage to the eyes, a condition known as retrolental fibroplasia.

Survival of premature infants

As indicated above, the prematurely born infant is considerably less likely to survive than are full-term infants. Premature infants, accounting for less than 8 percent of all live births, account for two-thirds of infant deaths. Even after the first year of life, the mortality rate among infants with low birth weights is greater than among infants with birth weights above 2,500 grams. The cause of this increased rate is not completely known, although a higher prevalence of congenital anomalies accounts for some of the difference. Moreover, retarded intellectual development and other abnormalities of the nervous system are more common in such infants, particularly those with birth weights of less than 1,500 grams (3.3 pounds). The majority of infants with low birth weights remain small throughout the childhood years, which may reflect a continued pattern of slow growth, first evidenced in the uterus.

Metabolic disturbances. Infants of diabetic mothers represent a unique group with special metabolic problems. Intrauterine death is common and unexplained. The placenta is often abnormal. The infants at birth generally are large and have large organs, a condition referred to as macrosomia. Respiratory distress and low levels of sugar in the blood (hypoglycemia) are common complications.

Neonatal hypoglycemia is a relatively common disorder, particularly among infants whose birth weight is low. Fifteen percent of hypoglycemic infants have associated abnormalities of the central nervous system. In most instances hypoglycemia is transient and responds readily to treatment.

Jaundice in the newborn is ordinarily related to an imbalance between the rate of destruction of red blood cells and the metabolism of hemoglobin to bilirubin and the rate of excretion of bilirubin in the bile; there is a resultant temporary elevation of bilirubin level in the blood. Jaundice may, however, be due to septicemia, to several different diseases of the liver, or to obstruction of the ducts through which bile flows into the intestinal tract. Abnormally high bilirubin levels have also been found in association with breast feeding; it is an extremely rare condition resulting from the presence of an unusual substance in the milk.

The significance of jaundice depends on the underlying cause and the amount of excess bilirubin in the blood. In extreme cases, bilirubin can be deposited in brain cells, resulting, as mentioned above, in severe nerve-cell damage, called kernicterus. This condition, which may lead to deafness and cerebral palsy, is encountered most often in infants with erythroblastosis fetalis, a blood disorder discussed below. Brain damage from an excess amount of bilirubin can usually be prevented by means of exchange transfusions (in which most of the infant's blood is replaced with blood from donors), which in the most severe cases may need to be repeated many times.

Kernicterus

Tetany of the newborn, a condition that appears within a few days after birth, is characterized by increased neuromuscular irritability, with muscular twitching, tremors, and convulsions. In most cases, the blood concentration of calcium is low, and that of inorganic phosphate is high. In some infants the disorder appears to be due to a low concentration of magnesium in the blood. The infant's condition is usually dramatically improved by the intravenous administration of calcium. The disorder is transient, so that treatment with oral calcium supplements can be discontinued after one or two weeks.

In contrast to the metabolic disturbances described above, which are generally transient conditions of the newborn, are the long-term disorders known as the inborn errors of metabolism. These result from the absence of a functional enzyme in a particular metabolic pathway. Because of this "enzyme block," there is a deficiency in the products of the affected pathway and an excessive build-up of harmful chemicals that cannot be processed normally. Inborn errors of metabolism are genetically determined, and most are very rare. Many lead to severe illness and brain damage unless effective and early treatment can be started. A well-known example is phenylketonuria, which can be detected by a simple blood-screening test (the Guthrie test) during the first week of life. Once identified, the affected infant is given a special diet that prevents brain damage and allows normal growth. The diet has to be continued until at least the age of 10 years, and some clinicians recommend that it be followed for life.

Inborn errors of metabolism

Infections. The newborn infant is subject to the ordinary infections and, in addition, to infection with commonly encountered organisms such as *Escherichia coli, Staphylococcus aureus,* and group B hemolytic streptococci, which are not usual causes of serious infection in

older age groups. Infection may be acquired in the uterus, during delivery, or later, in the nursery. Commonly encountered serious infections are pneumonia, meningitis (inflammation of the coverings of the brain and spinal cord), and septicemia (infection of the bloodstream). Often the infant shows few signs of the disease other than poor feeding, lethargy, pallor, or slight fever. Since the newborn infant's resistance to infection is poor, early diagnosis and treatment are particularly important. Often, treatment is given when infection is merely suspected.

Common infections

Congenital defects of each part of the immunologic system have been discovered. The most striking feature of these diseases is the inability of the patient to combat infection. Thus, untreated patients with some forms of agammaglobulinemia (lack of antibodies in the blood) may die from overwhelming infection in infancy or early childhood.

Respiratory disorders. Numerous abnormalities of respiratory function are common in the newborn infant. One of the most severe is respiratory distress syndrome (RDS; also called hyaline membrane disease). RDS occurs in 0.5 to 1 percent of all deliveries, and, as previously mentioned, is especially common in premature infants. In addition, it is encountered commonly in infants of diabetic mothers and after cesarean section (delivery through the wall of the mother's abdomen). RDS also occurs, albeit infrequently, in full-term infants without any apparent predisposing cause. Soon after birth, affected infants begin to take rapid, shallow breaths and can be shown by appropriate tests to be exchanging air (*i.e.*, absorbing oxygen and exhausting carbon dioxide) only poorly. Without expert treatment, they may die within a few hours or may have a protracted course over a period of several days, with later demise or gradual improvement and recovery. Treatment is directed at relieving the symptoms and includes correction of an associated acidosis, administration of oxygen, and assisting the infant to breathe, if necessary with a mechanical ventilation machine. With modern care, death has become less common.

Respiratory distress syndrome

Pneumonia is in infants a serious problem. The onset is either within hours after birth, in infants whose infection is contracted from the mother, or after 48 hours of life, when the infection is acquired after birth. Infants show signs of difficulty in breathing, and often there is an associated infection of the blood (septicemia). Treatment consists of the administration of carefully selected antibiotics in appropriate dosages and respiratory support.

Pneumonia

An infant may inhale meconium (a semisolid discharge from the infant's bowels) during the course of delivery, leading to obstruction of the upper airway. Clearing the airway with suction, the administration of oxygen, and general respiratory support are usually effective in promoting recovery within two to three days.

Leakage of air into the pleural space (between the membrane lining the chest and that enveloping the lungs and other thoracic organs), with consequent partial or complete collapse of the lung (pneumothorax), bleeding into the lung, and failure of expansion of the lung (atelectasis), also causes respiratory failure in the newborn infant. Prompt treatment is often necessary to ensure survival.

Cardiovascular disorders. Cardiovascular disturbances in the newborn are related primarily to congenital malformations that affect about seven out of every 1,000 infants. They vary from those that are incompatible with life to those that cause no illness and require no treatment. Sometimes the cause is known because of an association with a chromosomal disorder (*e.g.*, Down's syndrome and Turner's syndrome; see below); in a few the cause is maternal rubella infection. The lesions arise early in fetal development, and the result is usually either an obstruction of normal blood flow or an abnormal communication between different parts of the heart or the circulation. When the structural abnormality causes severe disturbance, heart failure results. The baby in heart failure may present such symptoms as a blue complexion (cyanosis), breathlessness, or feeding difficulties. Most congenital heart defects are associated with heart murmurs that can be heard with a stethoscope. The most common congenital lesion is a ventricular septal defect, which is a hole between the two lower chambers of the heart (the left and right ventricles). Many of these close spontaneously without treatment. Diagnosis of an infant with suspected congenital heart disease has been made surer and easier with the development of echocardiography. Most of the disorders that cause illness can be corrected by surgery, which—unless the defect is immediately life-threatening—is usually deferred until the child is older. For a fuller discussion of specific congenital cardiovascular defects, see CIRCULATION AND CIRCULATORY SYSTEMS: *Cardiovascular system diseases and disorders; Congenital heart disease.*

A specific cardiovascular problem common in the preterm infant is patent ductus arteriosus, which is the persistence of an essential feature of fetal circulation. The ductus arteriosus is a fetal blood vessel that connects the descending aorta and the pulmonary artery. It shunts blood from the lungs (which are nonfunctional in the fetus), channeling it toward the placenta (where oxygenation takes place). Normally, the ductus closes shortly after birth. When it remains patent (open) after birth, it functions as a shunt in the opposite direction, diverting blood from the aorta to the lungs. Thus, too much blood is delivered to the lungs, and the subsequent pulmonary congestion causes breathing difficulties. Drugs can be given to encourage the ductus to close. If drug treatment proves ineffective, the ductus may be closed surgically.

Blood disorders. The diseases affecting the blood of newborn infants include diseases of the red blood cells (particularly the anemias, which involve an inadequate level of functioning hemoglobin in the blood) and of the clotting factors (*e.g.*, hemophilia). These diseases and others that affect the blood of the newborn are discussed below, in the sections dealing with disorders associated with later infancy and childhood, and are covered in BLOOD: *Blood diseases.*

Erythroblastosis fetalis is a disease in which the red blood cells of the fetus are destroyed because of an incompatibility between the infant's blood and that of the mother. The severest form results from incompatibility between an Rh-negative mother and an Rh-positive fetus. If the mother has been sensitized (by previous exposure) to Rh-positive red blood cells, she will have circulating antibodies against the Rh factor. These antibodies can cross the placenta and destroy the red blood cells of her Rh-positive fetus. Unless the mother has been sensitized by blood transfusions, her first Rh-positive fetus is normally not affected. This is because her exposure to the fetal red blood cells is minimal until the delivery of the baby, when there is substantial transfer of fetal red blood cells to the maternal circulation. This exposure can sensitize the mother, and any future Rh-positive fetuses will be at risk. It is now standard procedure to administer anti-Rh serum promptly to an Rh-negative mother who has given birth to an Rh-positive child. The serum destroys any fetal red blood cells in her circulation before she becomes sensitized, thereby protecting future Rh-positive fetuses from erythroblastosis fetalis.

Gastrointestinal disorders. Vomiting, a common symptom among newborn infants, may be due to intestinal obstruction or to overfeeding or may occur without apparent cause. Continuous contraction of the muscle governing the opening between the stomach and the intestine may cause vomiting. This condition, called pyloric stenosis, may occur at any time in early infancy and usually requires surgical treatment.

The first bowel action and passage of meconium by the baby usually occurs within 12 hours. Delay may indicate an obstruction of the bowel. Important causes of obstruction are congenital narrowing (stenosis) or occlusion (atresia) of the intestine. These can occur at any site—from the duodenum (the first section of the small intestine) to the rectum and anus. Some babies are born with a small dimple or pit rather than a patent anus. Duodenal stenosis is particularly common in babies with Down's syndrome. Congenital obstructions of the intestines cause vomiting and constipation in early life; most can be corrected surgically.

Congenital bowel obstruction

Meconium ileus, intestinal obstruction by hard lumps of meconium, occurs almost exclusively in infants with cystic fibrosis, an inherited disease that is described below.