## Fertilization *in vitro*

# Chromosomal abnormalities in human embryos

*from R.G. Edwards*

CONVINCING and accurate data on the incidence of chromosomal abnormalities in human embryos growing *in vivo* or *in vitro* have been hard to gather. Difficulties have arisen in making clear and unequivocal chromosomal preparations from the few mitoses present in preimplantation embryos, and the incidence of abnormalities such as monosomy, trisomy, mosaicism and polyploidy during these early stages of growth has not been established. There is nevertheless little doubt that these forms of chromosomal imbalance could be very frequent after fertilization *in vivo* or *in vitro* in some circumstances, for example in embryos of older mothers.

The paper by Angell and collaborators in this week's *Nature* (p.336) reflects the difficulties found by others in establishing the correct karyotypes of cleaving human embryos. Most embryos could not be classified, but two notable and novel observations were made. Two of the eleven embryos observed were haploid or near-haploid, although one was classified only by DNA microfluorimetry. The other was undoubtedly gynogenetic or parthenogenetic in origin, since the three classifiable mitoses were maternal 22X −17. This remarkable embryo thus displayed two anomalies simultaneously, revealing a non-disjunctional event in meiosis or immediately post-fertilization and an ability of haploid embryos to reach the seven-cell stage. It provides concrete grounds to confirm predictions that early human development can begin without fertilization — a point for ethicists to ponder — and that monosomy might occur with some frequency in fertilized eggs.

The implications of these observations for clinics working on human fertilization *in vitro* are less certain. We found no haploid embryos among more than 25 examined chromosomally, even though exact counts could not be made in most of them. Eggs with one pronucleus are rare — very rare — during fertilization *in vitro*, especially in comparison with the incidence of haploidy reported by Angell *et al.* Their methods might encourage the pathogenetic activation of oocytes; for example, the use of nitrous oxide for the pneumoperitoneum during laparoscopy for oocyte recovery, and conditions in the culture medium as oocytes are carried to a nearby laboratory might contribute. Their unyielding treatment of patients with clomiphene, human chorionic gonadotropin and ultrasound 19 hours later could lead to unpredictable follicular responses and the collection of unripe oocytes.

Two other unbalanced embryos were found — a 47XY +D and another with metaphases apparently containing 44, 45 and 46 chromosomes respectively. This evidence was not unequivocal. There was some chromosome scatter from other metaphases in both embryos, and the blastomeres were uneven in one of them. Most embryos were unfortunately classified by fluorimetry rather than karyotypes.

It would be premature to relate the extremely high incidence of chromosomally imbalanced embryos to other work on fertilization *in vitro* until more evidence is forthcoming. No one doubts that many such embryos conceived *in vivo* and *in vitro* fail to develop to full term or even to implantation, and occasional trisomic, monosomic and triploid abortuses have been reported after fertilization *in vitro*. There is a wealth of knowledge to be gained on the exact incidence and type of chromosome disorders in early human embryos conceived in various circumstances, for example in different age-groups of patients and in various clinical conditions. □

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## Marine technology

# Boiling deep beneath the ocean

*from Roger N. Anderson*

IT is ironic that the oldest marine geological technique has presented the most recent surprise from the mid-ocean ridges. High technology has been responsible for a long series of discoveries that has remoulded our ideas of how the sea floor cools at the volcanically active Mid-Ocean Ridge. Bottom television, deep-sea drilling and deeply towed remote-sensing packages have been the kinds of tool that first discovered, then described, the 'Black Smoker' hot springs which pour forth 350°C metal-laden water onto the sea floor beneath up to 2 miles of ocean. These hot springs, found active for the first time in 1979, give us a glimpse of how metal deposits, such as massive sulphides, are formed.

Now a technique used on HMS Challenger to collect the first rock samples from the deep sea floor of over 100 years ago has delivered new scientific wonders. A 'dredge' is merely a large bucket dragged blindly across the sea floor and connected to the ship on the surface only by wire rope. J.R. Delaney and B.A. Cosen (*Mar. Technol. Soc. J.* **16**, 62; 1982) report inclusions, or little bubbles, of super-high-salinity water in basalts dredged from the Mid-Atlantic Ridge. They conclude that boiling has taken place in the hot spring system that generated the fluid inclusions. Boiling has never before been found beneath the deep sea for the weight of two miles of water was thought to make it impossible.

For boiling to occur on the Mid-Atlantic Ridge, hot spring water must move upwards from its heat source — magma within a volcano — faster than it loses heat to the rock during its traverse to the surface. This requires a chimney, such as those observed by a diving submersible on the East Pacific Rise crest (Rise Project Group, 1980). Any good chimneysweep will tell you that hot vapour mixing with cold will precipitate a good coating on the wall of a chimney.

On the Mid-Ocean Ridge, this coating is made up of metals and, as Delaney and Cosens point out, boiling changes the kinds of metal deposited as the hot spring fluid billows forth. At some depth within a Mid-Atlantic Ridge chimney, boiling occurred in the past when the temperature of the hot water became high enough to intersect the liquid–vapour phase transition curve. (If, however, hydro thermal fluid passing up a chimney intersects the sea floor before reaching the *P–T* boiling curve, no steam will occur.) The steam that then formed left behind liquid of very high salinity, just as the Great Salt Lake formed by evaporation. Some of that liquid ended up as fluid bubbles in the rock dredged, fortuitously, millions of years later.

But, what is really exciting is what Delaney and Cosens predict the steam carried to shallower parts of the chimney — gold and silver! In mines on land, lead, copper and zinc are found in the portion of high-salinity chimneys deeper than the boiling and gold and silver are found in the steam-dominated shallow parts. But don't get your pan out yet! There is probably no mother lode in the deep sea floor that any one could reach even with futuristic mining equipment. But scientific tools such as those which might be lowered into a deep-sea drilling borehole or down a chimney by a diving submersible might find a steam vent where we could observe precious metal deposits forming *in situ* for the first time ever. Then we might learn of places on land to look — places we haven't thought to look before. □

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